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NATIONAL DAM INSPECTION REPORT. LOWER WOODS POND DAM (PA-00152,--ETC(U)
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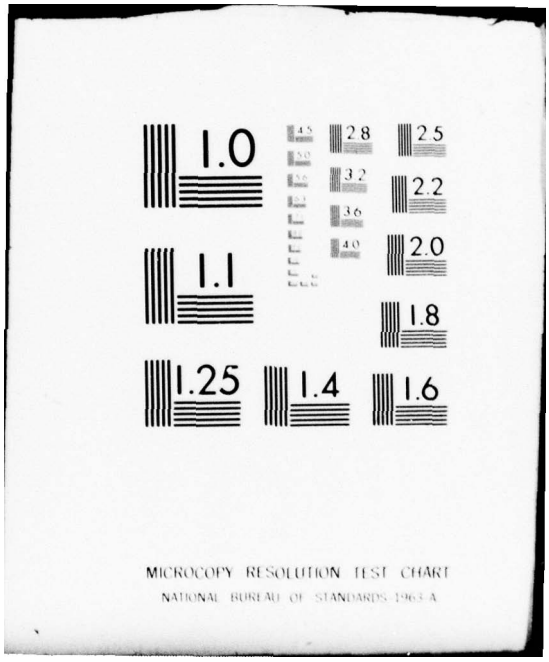
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LOWER WOODS POND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

DECEMBER 1978

(6) National Dam Inspection Report. Lower Woods Pond Dam (PA-00152, DER I.D. 64-11), Delaware River Basin, E. Branch Dyberry Creek, Wayne County, Pennsylvania. Phase I Inspection Report.

(1)

DELAWARE RIVER BASIN

LOWER WOODS POND DAM
WAYNE COUNTY, PENNSYLVANIA

NDS I.D. NO. PA 00152
DER I.D. NO. 64-11

(11) Dec 78

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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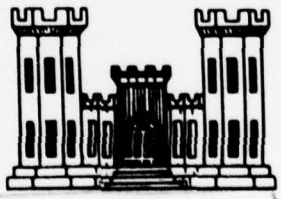

(10) John Boschuk, Jr.
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Prepared by:

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Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

DECEMBER 1978

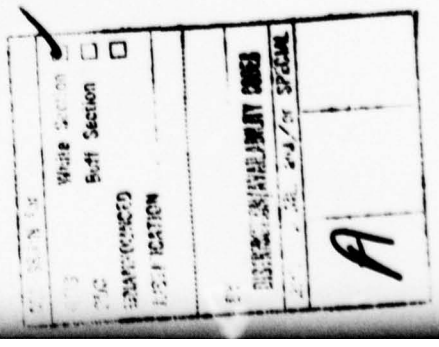
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Lower Woods Pond Dams
County Located:	Wayne County
State Located:	Pennsylvania
Stream:	East Branch of Dyberry Creek
Coordinates:	Latitude 41° 44.3'
	Longitude 75° 16.2'
Date of Inspection:	24 October 1978

ABSTRACT

Lower Woods Pond Dam is a series of three dams owned by the Pennsylvania Fish Commission which were rebuilt in 1956 by the Fish Commission. The facility is considered to be in good condition and well maintained. Collectively, the dams are classified as a "High" hazard potential structure consistent with its potential to cause extensive property damage and possible loss of life in the event of failure. The dams are also classified as an "Intermediate" size structure based on its 1,470 acre-feet storage capacity.

The design data and supplemental information pertinent to this structure were sufficient to evaluate it and the appurtenant structures in accordance with Phase I Guidelines. The hydrologic and hydraulic calculations ~~presented in Appendix C and discussed in Section 5~~ indicate that the structure will pass 60 percent of the Probable Maximum Flood. Since the dams will be overtopped by one foot during the Probable Maximum Flood, the spillway systems are considered to be "Inadequate" but not "Seriously Inadequate".

Significant findings of the visual inspection noted seepage at the downstream toe of Dam Nos. 1 and 3, and some minor seepage beyond the toe of Dam No. 2. All seepage was clear and appeared to be a long-term stable condition. Because of the age of the structures, the lack of construction records, and the probable lack of internal drainage control structures, the following remedial measures are recommended in order of priority:

1. Embankment and toe seepage for Dam Nos. 1 and 3 should be evaluated. The rates of seepage should be monitored and recorded on a periodic basis for changes in rates or turbidity.

2. Should the results of the seepage evaluation and monitoring warrant precautionary measures, an inverted filter or an equivalent seepage control system should be installed on the embankment. An increase in the seepage flow from the toe of the dam could indicate a long-term piping problem, which should then be studied in detail and remedial measures taken.

3. Woody vegetation on the masonry section of Dam No. 1 is undesirable and should be removed from the face to facilitate inspection of seepage and the condition of the wall.

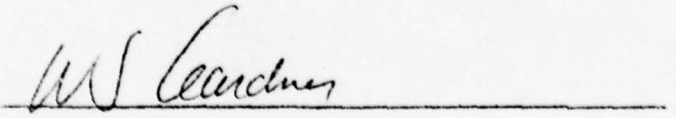
4. Crest monuments should be installed on Dam No. 1 to monitor embankment movements.

A maintenance inspection checklist should be developed to help insure that all critical items are regularly inspected and maintained. The existing emergency plan established by the Pennsylvania Fish Commission should be expanded to include a procedure in the event of an emergency for warning downstream residents.

25 Jan 79

John Boschuk, Jr., P.E.
Pennsylvania Registration 27450E
Woodward-Clyde Consultants

Date



25 Jan 79

William S. Gardner, P.E.
Pennsylvania Registration 4302E
Woodward-Clyde Consultants

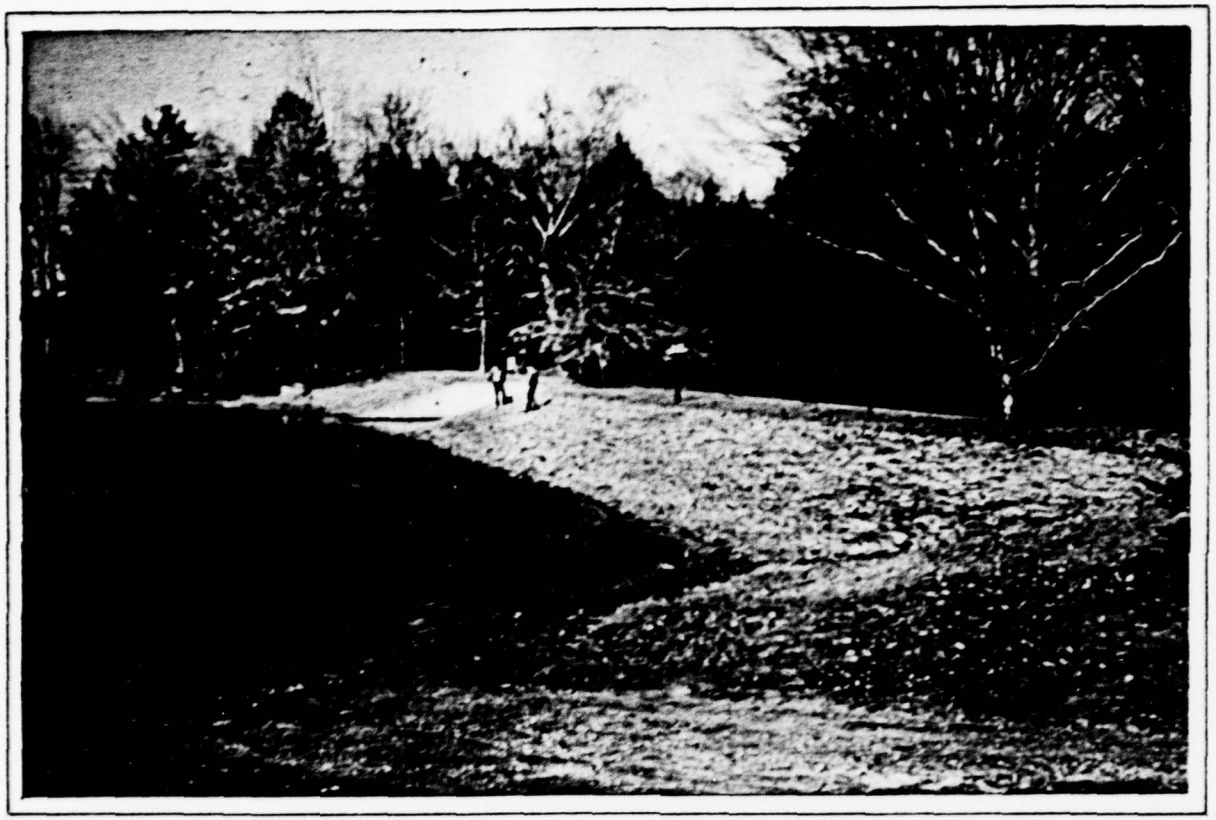
Date

APPROVED BY:

16 Feb 79

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date



OVERVIEW
LOWER WOODS POND DAM, WAYNE COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LOWER WOODS POND DAM
NATIONAL ID #PA 00152
DER #64-11

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lower Woods Pond Reservoir was created by the construction of three embankments as shown on Plate 2, Appendix E. Embankment No. 1 consists of a reconstructed earthen embankment incorporating an older masonry dam with an upstream earth embankment. Embankment Nos. 2 and 3 consist of rehabilitated earth embankments constructed across topographic lows and valleys. Embankment Nos. 2 and 3 are shown on Plate 5, Appendix E. The upstream slopes of the embankments are 3H:1V and, with the exception of the masonry

portion at Embankment No. 1, the downstream slopes are generally 2.5H:1V. The downstream slope of the masonry portion of Embankment No. 1 is generally 1H:1V or steeper. Typical embankment profiles are shown on Plate 5, Appendix E. The lengths of Embankment Nos. 1, 2 and 3 are 420 feet, 220 feet and 265 feet, respectively. The maximum height is 21 feet at Embankment No. 1. The three embankments impound a reservoir of approximately 91 acres within a 3.14 square mile drainage basin. As shown on Plate 1, the drainage basin contains an upstream natural lake, Upper Woods Pond. Hereafter, these embankments will be addressed as Dam No. 1, Dam No. 2 and Dam No. 3, which collectively create Lower Woods Pond Dam.

Dam No. 1 was redesigned with a standard Pennsylvania Fish Commission intake tower located within the embankment immediately upstream of the centerline. The tower contains an interior overflow weir formed by stoplogs. Water enters the tower through a 3 foot by 3 foot concrete conduit extending from the upstream toe through the embankment to the intake tower base. A 3 foot by 3 foot concrete conduit discharges from the tower to the downstream toe. The conduit entrance invert elevation is 1,398 feet, and the exit invert elevation is 1,396.9. The crest of the stoplog weir can be varied, but it is reported to be at approximately normal pool level of about elevation 1,412. There are three anti-seep collars around the conduit. Two are located upstream and one is located downstream of the tower. (See Plate 3, Appendix E.)

The emergency spillway is located near the left abutment of Dam No. 2. The spillway weir is at elevation 1,412 and is 40.5 feet long. The 36 foot long concrete approach channel and the 26 foot long discharge channel are at

elevations 1,408.0 and 1,407.8, respectively. Typical plan and profile of the spillway is shown on Plate 4, Appendix E.

b. Location. The embankments are located on the East Branch of Dyberry Creek, approximately 4,000 feet north of the intersection of Route 371 and Dyberry Creek Road in Lebanon Township, Wayne County, Pennsylvania. The embankments and reservoir are shown on USGS Quadrangle entitled, "Aldenville, Pennsylvania" at coordinates N 41° 44.3' W 75° 16.2'. A regional location plan for Lower Woods Pond is enclosed as Plate 1, Appendix E.

c. Size Classification. All three dams are classified collectively as an "Intermediate" size structure consistent with its 1,470 acre-feet total storage capacity.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive damage and possible loss of life. Downstream residential dwellings exist along the East Branch of Dyberry Creek at the intersection of Dyberry Creek Road and Route 371 as shown on Plate 1, Appendix E.

e. Ownership. The dams are owned and maintained by the Pennsylvania Fish Commission. All correspondence should be sent to Mr. E. J. Grindall, Senior Project Engineer, Pennsylvania Fish Commission, Bureau of Fisheries and Engineering, Robinson Lane, Bellefonte, Pennsylvania 16823.

f. Purpose of Dams. The purpose of the dams is to form a reservoir for use as a recreational area.

g. Design and Construction History. The first dams at this site were built in 1848 by the Delaware and Hudson Canal

Company to supply water to the company's canal system. The original inventory inspection of Dam No. 1 was made in 1914 and reported on after a 1917 inspection. At that time, this dam was reported to be 30 feet high, a figure not supported by subsequent reports. The outlet indicated was an 8 foot by 8 foot sluiceway through the center of the embankment. The side walls and channel bottom were reported to consist of heavy cut stone masonry. The timber framing and wooded flood gate were reported to be decayed and to no longer regulate the water elevation. The upstream faces were protected by riprap from the crest to the toe. The downstream face was retained by a dry stone wall.

This embankment was again inspected in 1930, but it was not until the 1931 inspection that the existence of the other two embankments was reported. The 8 foot high embankment, now called the No. 2 dam, was reported to contain a spillway 11 feet long by 5 feet deep with masonry abutments. A plank spillway floor was almost rotted through at the time of the 1931 inspection. The second dam discovered, now called Dam No. 3, was reported as 10 feet high and 250 feet long and riprapped on both faces. No spillway was indicated.

In about 1890, the canals were closed and the pond was used for fishing. In 1930, the property was owned by Riefler and Sons, Inc., and in May 1931, was purchased by the Tanners Falls Development Corporation. Between 1937 and 1941, it was transferred to the Pennsylvania Game Commission, and in late 1954 or early 1955, to the Pennsylvania Fish Commission.

Numerous letters between the State and the various owners advised to either repair the spillway in Dam No. 1 or breach the structure. A 1949 newspaper article stated that the dam was breached by a severe storm in 1936. Correspon-

dence and inspection reports make no mention of breaching although the 1936 inspection report states there was evidence of recent high water which weakened the abutments. In 1948, the Pennsylvania Game Commission stated their intention to rehabilitate the dams when funds became available. The State in 1949, strongly recommended that the spillway be repaired or the structure be breached. Downstream residents also petitioned the Department of Forests and Waters for repairs to the dam and spillway. Records indicate the dam was breached in 1949. In 1953, the Game Commission submitted plans for rehabilitation of the dams, but little or no work was performed. The Fish Commission subsequently submitted a new set of plans which were approved in 1956. The work was performed by Pennsylvania Fish Commission employees and completed by the end of 1956. Plans and specifications were prepared by Mr. Thomas F. O'Hara, Registered Engineer of State College, Pennsylvania. Concrete testing was performed by Pittsburgh Testing Laboratory.

h. Normal Operating Procedures. Under normal conditions reservoir outflow is controlled both by the stoplog weir system located inside the intake riser and the emergency spillway located in Dam No. 2. Should it be necessary to lower the reservoir, the normal procedure is to remove stoplogs from the intake tower, lowering the reservoir to the desired level. Flow in excess of the intake riser capacity is discharged over the emergency spillway. The minimum flow requirement downstream for this dam is 0.47 cfs.

1.3 Pertinent Data.

A summary of pertinent data for Lower Woods Pond is presented as follows:

a.	Drainage Area (sq. miles) (1.26 sq. miles of the total area is controlled by an upstream natural lake, Upper Woods Pond.)	3.14
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood	Unknown
	Maximum Design Flood	2,280
	Minimum Required Flow	0.47
c.	Elevations (feet above MSL)	
	Top of Dam (all three)	1,418.0
	Emergency Spillway	1,412.0
	Tower Inlet and Pond Drain Invert (approx.)	1,398.0
	Outlet Invert Elevation	1,396.9
	Normal Pool	1,412.0
	Maximum Known Flood	Unknown
d.	Reservoir (miles)	
	Length at Normal Pool	0.8
	Fetch at Normal Pool	0.8
e.	Storage (acre-feet)	
	Normal Pool	890
	Top of Dam	1,470
f.	Reservoir Surface (acres)	
	Normal Pool	91
g.	Dam Data	
	Type	Earth embankments.

Length	No. 1: 370 ft No. 2: 250 ft No. 3: 280 ft
Height (Largest Dam, No. 1)	21 ft
Crest Width	12 ft
Side Slopes	
Upstream	3H:1V
Downstream (except masonry section)	2.5H:1V
Downstream (masonry)	1H:1V or steeper
Cutoff	Unknown
Grout Curtain	Unknown (probably none).

h. Spillway

Type	Concrete
Location	At Dam No. 2.
Width	40.5 ft
Discharge Chute	Concrete channel leading to rock lined channel.

The above elevations are based on the top of dam elevation, assumed to be 100 on the drawings, which is equivalent to elevation 1,418, as estimated from the USGS Map. The datum noted on the reconstruction drawings is based on the *1890 USGS survey.*

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data for Lower Woods Pond is presented on the checklist attached as Appendix A. Principal documents containing pertinent data used for this report are as follows.

1. "Report Upon the Lower Woods Pond of Reifler and Sons" prepared by R. J. Gillis, Assistant Engineer, dated August 3, 1917.

2. "Report Upon the Application of the Pennsylvania Game Commission" prepared by Mr. R. J. Alert, Junior Dam Engineer, dated April 23, 1953.

3. "Report Upon the Application of the Pennsylvania Fish Commission" prepared by Mr. G. E. Thomas, Chief, Division of Dams, dated April 30, 1956.

4. A four-sheet set of drawings entitled "Rebuilding Existing Dam, Lower Woods Pond" prepared by Mr. T. F. O'Hara, Registered Engineer, State College, Pennsylvania, dated October 1955.

5. Eight black-and-white photographs which are dated 1917, 1937 and 1949.

6. Miscellaneous letters, correspondence, memos, inspection reports and other pertinent documents

located in the Department of Environmental Resources (DER) files in Harrisburg, Pennsylvania, or Pennsylvania Fish Commission files.

The data available, coupled with the results of the field investigation, is believed to be sufficient to describe and provide a judgemented assessment of the principal features of the dams and discharge systems. However, this data is very limited and does not include slope stability analysis, calculations for seepage analysis, hydraulic analysis and other pertinent design calculations.

b. Design Features. The principal design features of Lower Woods Pond Dam and appurtenant facilities are reproduced from drawings provided by the Pennsylvania Fish Commission, and included in Appendix E as Plates 2 through 5. A brief description of the dam is located in Sub-Section 1.2 of this report. Dam No. 1, as shown in Appendix E, Plate 5, is an earthen embankment composed of materials classified as clayey impervious soils (Class A), and more pervious rocky materials (Class B). A more definite description of these materials could not be located. The upstream slope is protected with riprap and, although not shown on construction drawings, the riprap is believed to have a 6-inch gravel filter bed, based on conversations with Fish Commission representatives. The upstream side was constructed to a 3H:1V slope. The downstream slope was constructed to a 2.5H:1V slope and is grass covered. The masonry section is somewhat steeper.

When Dam No. 1 was replaced, the downstream face was covered with grass, but the right portion of the embankment was left intact with the original, vertical, dry masonry wall. Contained within the new embankment is a standard Fish Commission riser with a stoplog weir system. The logs are stacked to the desired pool elevation and water enters at

elevation 1,398 through the upstream slope into a 3-foot square concrete culvert, rising up and over the stoplogs and discharging out a 3-foot square concrete discharge conduit at an exit invert of 1,396.9.[1] The concrete conduit contains three concrete anti-seepage collars, two located upstream of the riser and one located downstream of the intake riser.

Dam No. 2 consists of a Class A material shell over the existing embankment. The dam also contains the new emergency spillway. The emergency spillway is 40 feet 6 inches long and contains a triangular concrete overflow weir with a crest elevation of 1,412. Water is channeled over the spillway between two concrete retaining walls which have anti-seepage fins at the embankment centerline. Water discharges over the crest onto a reinforced concrete basin at elevation 1,407.5 and discharges downstream under a foot bridge as shown in Photograph 4, Appendix D.

Dam No. 3 is located as shown on Plate 2, Appendix E and consists of a Class A material shell over the existing embankment. Both Dam Nos. 2 and 3 were rehabilitated to a 3H:1V upstream slope and 2.5H:1V downstream slope. In both cases, the upstream embankment is protected with riprap and it is believed, although not shown on construction drawings, that the riprap sits on 6-inch thick filter layer. It is not known if the foundation was grouted or if a concrete cutoff trench or core wall is located beneath any of these structures. It is considered unlikely that either grouting was performed or a cutoff trench or core wall was installed.

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(1) It is noted that these are assumed elevations based on the USGS Quadrangle Map.

2.2 Construction.

A description of the construction history is presented in Section 1.2. The new spillways were designed and the construction supervised by the Pennsylvania Fish Commission. All construction work was performed by Pennsylvania Fish Commission employees.

2.3 Operation Data.

There are no operational records maintained for this structure. A minimum flow of 0.47 cfs is required for this structure, but there are no records documenting this flow.

2.4 Evaluation.

a. Availability. All engineering data reproduced in this report and described herein and studied for this investigation were provided by the DER and supplemented by the Pennsylvania Fish Commission.

b. Adequacy. The data available is believed adequate to define the basic geometry of the embankments and appurtenant facilities, but did not include design computations or a detailed hydrology/hydraulic analysis. Selected features of the dams, which included the crest width, upstream slope, downstream slope, emergency spillway dimensions and other miscellaneous data were field-checked and compared with the drawings prepared by Mr. Thomas F. O'Hara. These checks verify that the dams, reconstructed in the 1950s, were built in basic accordance with the drawings.

With the exception of concrete test results, construction documentation was lacking, particularly of the new embankment section of Dam No. 1. It is also not known how Dam No. 1 was tied together with the existing masonry structure, and whether there are appropriate filters between the zones of earth and masonry. Since there were no stability calculations available, and since the types of embankment materials could not be identified, the stability of the structures could not be quantified.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated in the following sub-sections. In general, the appearance of the facility indicates that the dam is well maintained and in good condition.

b. Dam. According to the visual inspection, there were no indications or evidence observed of distortions in the crest alignment or in movement of the crest that would be indicative of foundation settlement, movement or imminent failure of the structure.

Within Dam No. 1, clear seepage was observed at the base of the masonry section of the main dam. Since the area was overgrown with weeds and debris, fallen trees, dead wood, etc., the quantity of seepage could not be determined. If drains are located in the downstream face of this masonry portion, they could not be found, nor could any other water passages or other pressure release systems be located. There were no unusual vertical or horizontal movements noted in the masonry structure. Within the embankment portion, there were no surface cracks observed and no unusual movement or cracking at or beyond the toe.

There was 0.4 feet of settlement noted at the right side of the spillway wall in Dam No. 2. However, the concrete anti-seep fin was at the design elevation, and this slight

depression does not affect the storage capacity of the reservoir.

There were no riprap failures observed on any of the upstream slopes. There was no significant distortion or movement of this riprap. There was no significant erosion or deterioration at the junctions of any of the dams or along the slopes of any dams, both upstream and downstream.

Clear seepage was noted beyond the toe of all three embankments, particularly of embankment No. 3, where the entire area beyond the downstream toe was marshy. At Dam No. 1, considerable seepage was noted beyond the toe between the natural hillside of the right abutment and the discharge channel. There was minor seepage adjacent to the discharge channel approximately 175 feet downstream of the No. 2 dam.

c. Appurtenant Structures.

1. Intake Conduit. The exposed sections of the principal spillway were inspected, which included the top of the tower and the conduit outlet (Photos 2 and 3). The inside of the riser could not be inspected as the access hatch was locked. No significant concrete cracking, spalling, or signs of deterioration were noted.

2. Spillway. The approach channel was assessed to be in good condition as well as the concrete retaining walls on each side of the spillway. One minor crack was noted on the concrete wall near the anti-seepage collar. However, this crack is not considered to be critical or to affect the structural integrity of the wall.

The sharp crested triangular weir was observed to be in good condition. Two logs were floating against the weir, but such debris is not likely to lodge at the weir during a flood occurrence and reduce spillway discharge. The discharge channel between the weir and the bridge is in good condition. The wood foot bridge downstream of the spillway with stone piers is considered to be in fair condition and is not expected to survive a severe storm. Destruction of the bridge is not expected to affect the spillway discharge capabilities.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability, or other features that would significantly affect the flood storage capacity of the reservoir. All slopes are well vegetated with an assortment of hardwood and softwood trees.

e. Downstream Channel. Immediately downstream, both the principal spillway and emergency spillway discharge into rocky stream channels which converge approximately 250 feet downstream from the emergency spillway. The channel was inspected and is assessed to be in good condition. At the intersection of Dyberry Creek Road and Route 371, approximately 1 mile below the dam, are several structures including residential dwellings which would be subject to damage.

3.2 Evaluation.

In summary, the visual survey of the dam disclosed that the embankments and spillways are in relatively good condition. Seepage was noted at the downstream toe of the masonry portion of Dam No. 1. Marshy areas were also noted downstream of Dam Nos. 2 and 3. It is adjudged that this clear seepage has been occurring for many years, and is reported by

Fish Commission representatives that it is not increasing. However, this seepage is undesirable and should be monitored. Pending the results of the monitoring program, corrective actions may be warranted as described in Section 7.

Since the interior portions of the principal spillway riser and conduit were inaccessible, they could not be inspected. The emergency spillway was inspected and is assessed to be in good condition.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Normal operating procedures do not require a dam tender. There are no written operating procedures for this dam.

4.2 Maintenance of the Dam.

The dam is maintained by the Pennsylvania Fish Commission which periodically mows the grass and perform minor repairs as necessary.

4.3 Maintenance of Operating Facilities.

Maintenance of the operating facilities is performed by the Pennsylvania Fish Commission. Maintenance consists primarily of checking the interior of the riser for accumulation of trash and debris. The emergency spillway is also inspected for an accumulation of trash and concrete deterioration.

4.4 Warning Systems In Effect.

There is an interim emergency plan to be followed by the Wayne County Waterways patrolman or deputy patrolman during periods of heavy precipitation. The plan includes a checklist of conditions which may indicate imminent failure of

the dam and telephone numbers to call at any time of the day or night. However, there is no formal procedure of warning residents that a hazardous condition has developed or if high flow conditions are anticipated.

4.5 Evaluation.

There are no written operating procedures nor a procedure for warning downstream residents of possible danger. Commensurate with the possibility of loss of life and extreme property damage at the intersection of Route 371 and Dyberry Creek Road in the event of failure or the passing of exceedingly high flows, a formal warning procedure should be implemented.

An operating procedure with an inspection checklist should also be formulated and implemented by the Pennsylvania Fish Commission. Although the reservoir can be lowered by removal of stoplogs, the procedure is difficult and time consuming. It is concluded that rapid draw-down procedures should be evaluated and, if necessary, a sluice gate system should be installed to drain the reservoir.

An operational manual, maintenance manual and maintenance inspection checklist should be formulated. The listing should include all critical items of the facility to be inspected or maintained and the inspection/maintenance should be performed on a regular basis.

The interim warning procedure should be formalized and expanded to include a definite procedure to warn downstream residents that high flows are expected. An evacuation plan should be formulated.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. No original hydrologic design data of the reconstructed spillway exists, although there was a hydraulic design performed. These hydraulic calculations, dated 30 April 1956, are in the Pennsylvania Fish Commission files. The total watershed above Lower Woods Pond Dam is about 2.1 miles long, averaging 1.5 miles wide with a total drainage area of approximately 3.14 square miles. About 4,000 feet above the upper end of Lower Woods Pond Reservoir is Upper Woods Pond, a 79-acre natural lake. Its drainage area is 1.26 square miles and the watershed is about 1.9 miles wide and 0.8 miles long. In the upper reaches of each watershed is a swamp of about 40 acres and 55 acres, respectively. See Plate 1, Appendix E. The entire watershed is approximately 85 percent wooded with no residential development. As more than half of the watershed is State Game Lands, the runoff characteristics are not expected to change in the future.

The 1956 calculations indicate that the spillway for Lower Woods Pond should be designed to discharge not less than 750 cfs per square mile of drainage area. The calculations also indicated a total drainage area of 3.04 square miles, as determined from the USGS maps, somewhat less than the 3.14 square miles determined from USGS maps for this investigation. The spillway was sized to discharge 2,280 cfs with a head of 6 feet.

In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design

flood for this "Intermediate" size dam and "High" hazard potential classification, is the Probable Maximum Flood (PMF).

b. Experience Data. No reservoir water level records or rainfall records are maintained.

c. Visual Observations. On the date of the inspection there were no conditions observed that would indicate that the outlet capacity would be reduced during a flood occurrence. Observations regarding the condition of the downstream channel, spillway conditions and reservoir are located in Appendix B and also described in Section 3 of this report.

d. Overtopping Potential. The overtopping potential was estimated using the "HEC-1, Dam Safety Version" computer program. A brief description of the program and the computer printout, including a summary table, are included in Appendix C. Calculations for this investigation confirm the design spillway capacity, a discharge of 2,800 cfs with the reservoir level at the top of the dam. The HEC-1 computed peak PMF inflow is about 7,630 cfs. Lower Woods Pond inflow hydrograph results from the routed outflow of Upper Woods Pond, a natural lake which cannot fail, added to the runoff from the uncontrolled portion of Lower Woods Pond watershed. The spillway can pass approximately 60 percent of the PMF storm without overtopping the embankment. The PMF storm can be expected to overtop the embankment by a maximum of one foot. The 60 percent value is a minimum value as no allowance has been made for the temporary flood storage afforded by marshy areas above Upper Woods Pond and Lower Woods Pond.

e. Spillway Adequacy. The spillway is rated as "Inadequate" but not "Seriously Inadequate", as the dam will pass more than 50 percent of the PMF storm without overtopping

the embankment. The maximum spillway discharge capacity is judged not to be reduced by a high tailwater elevation.

f. Downstream Conditions. Lower Woods Pond Dam is located about 1 mile above PA Route 371 where there are two homes subject to damage in the event of dam failure. Further downstream along the east branch of Dyberry Creek are homes built adjacent to the creek in the flood plain, which are also subject to damage.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual inspection of Lower Woods Pond Dam and its appurtenant facilities indicated no existing embankment stability problems or structural problems associated with the intake riser or the emergency spillway. It is noted that the intake riser and the discharge conduits could not be inspected as the riser access hatch was locked.

There was no evidence of slope instability in the form of surface cracks, unusual movement or cracking at or beyond the toe, sloughing or erosion of the embankment, differential settlement along the crest or riprap failures. However, significant clear seepage was noted downstream of Dam Nos. 1 and 3 at and beyond the toe. These seepage areas produced marshy zones immediately downstream of the embankments. There was also some minor seepage downstream of Dam No. 2. A careful inspection of the seepage zones indicates long-standing stable conditions.

The hand-placed riprap on the upstream slopes of all three embankments was found to be in good condition. The quality of the rock was assessed to be excellent. The downstream slopes on all three dams are in good condition, grass covered and, evidently, well maintained. The masonry portion of Dam No. 1 was assessed to be in good condition. The downstream slope showed little or no sign of distortion. There is undesirable woody vegetation growing between the masonry blocks and on the slopes. The woody vegetation is undesirable and should be removed.

The spillway at Dam No. 2 was inspected and found to be in good condition with only one or two minor cracks at the junction between the spillway wall and the anti-seep fins. There were no other signs of excessive deterioration, cracking or general deterioration of the concrete and/or the rocklined channel.

b. Design and Construction Data. All available design documentation, including design drawings, a five-page set of concrete design calculations, and other miscellaneous correspondence was reviewed and assessed for completeness. The detailed listing of this data is included herein as Appendix A and discussed in Section 2.

Representatives of the Pennsylvania Fish Commission searched their files and supplied the limited design data reviewed for this inspection. The concrete calculations associated with the box culvert, outlet tunnel and spillway retaining walls were reviewed and assessed to be sufficient for an evaluation of the structures. Based on these calculations, an inspection of the spillway retaining walls, and the four drawings prepared by Mr. Thomas F. O'Hara, it is judged that the culvert and spillway were designed using reasonable assumptions and procedures, and that the structures are functioning as designed.

There was no stability analysis, seepage analysis or related calculations available for review, although the configuration of the embankment and the results of the visual inspection are sufficient to make a quantitative assessment of the embankment and stability. It is judged that the embankment configuration is reasonable.

The foundations of these structures could not be inspected, and documentation regarding the foundation preparation of the dams was unavailable. The unavailable documentation, which is normally necessary for a comprehensive Phase

I investigation, included the details of the reconstructed portion of Dam No. 1, including such items as a grout curtain, cutoff trench, embankment filter and drainage systems, and other seepage control mechanisms. This documentation is no longer believed to exist. Therefore, judgement as to the cause of toe seepage and the cause for the marshy areas downstream could not be ascertained. Commensurate with these findings, remedial measures to stabilize these seepage zones are presented in Section 7.

c. Operating Records. Available records in Department of Environmental Resources files indicate a required minimum flow release of 0.47 cfs. Although there was no evidence to indicate that this minimum flow is being maintained, it is judged that the seepage emanating from the downstream slopes of Dam Nos. 1 and 3 would satisfy this requirement. To the knowledge of Pennsylvania Fish Commission representatives, there were no procedures established to operate this facility.

d. Post-Construction Changes. There are no reports, nor is there any evidence, that modifications or alterations were made to this dam after reconstruction in 1956.

e. Seismic Stability. This dam is located in Seismic Zone 1. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake condition. Since the static stability analysis could not be reviewed, the seismic stability of the dam could also not be evaluated.

f. Upstream Dam. Upper Woods Pond, which is located upstream of Lower Woods Pond, was inspected and assessed to be a natural lake with no potential for failure. The hydrologic and hydraulic aspects of this lake as they affect the flow through Lower Woods Pond are discussed in Section 5.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. The visual inspection and review of available documentation indicates that the embankments and appurtenant structures of Lower Woods Pond Dams are in generally good condition. There were no observed signs of differential crest settlements, downstream slope discontinuities or upstream riprap movements. There was visible seepage through the downstream toe and beyond the toe through Dam Nos. 1 and 3, and minor seepage downstream of Dam No. 2. This seepage is clear and appears to be stable. The foundation conditions and drainage control structures could not be assessed, as data was not available. Therefore, a thorough evaluation of the seepage could not be performed.

The spillway approach and discharge channels were inspected and found to be in good condition. However, the foot bridge located immediately downstream, as shown in Photograph 4, is on rock piers and, in the event of a severe storm, is expected to be washed out. The spillway discharge capacity is not expected to be affected by failure of this bridge.

Since the intake tower was locked, the interior portions of the conduit and intake riser could not be inspected. In any event, water was at normal pool and flowing over the stoplog system, precluding a thorough inspection of the tower interior. Therefore, access was not considered critical. However, the exposed portions of these structures were carefully inspected and found to be in good condition.

The hydrologic and hydraulic computations presented in Appendix C indicate that the dam will pass 60 percent of the Probable Maximum Flood without overtopping. However, during the Probable Maximum Flood the dam will be overtopped by one foot. Therefore, the spillway systems of this structure are considered to be "Inadequate" but not "Seriously Inadequate".

b. Adequacy of Information. Structural calculations were available concerning the design of the culvert and the spillway retaining walls. These calculations were sufficient to evaluate the design of the structures. Other design calculations such as slope stability computations, filter and drainage designs, and construction testing associated with the embankment materials were not available. This visual inspection and the construction documentation in the Pennsylvania Fish Commission files provided sufficient evidence to indicate that the reconstruction work was performed in general accordance with the designers' recommendations. A few concrete cylinder test results by Pittsburgh Testing Laboratories were found in the Pennsylvania Fish Commission files. These results indicated that the concrete exceeded specification requirements. Based on this available information, it is concluded that the data was sufficiently adequate to evaluate the dams for a Phase I investigation.

c. Urgency. The recommendations presented in Section 7.2 should be implemented as soon as practical.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be undertaken. These recommendations are presented

in order of priority but do not indicate that the latter recommendations are not important.

1. Embankment and toe seepage for Dam Nos. 1 and 3 should be evaluated. The rates of seepage should be monitored on a periodic basis for changes in rates or turbidity. Seepage beyond Dam No. 2 has been assessed and is not judged to be critical.

2. Should the results of seepage evaluation and monitoring warrant, a detailed study of the condition should be made and necessary remedial measures taken. If seepage exiting from the toe or masonry section of Dam No. 1 increases, the possibility of piping of the upstream earth section should be studied in detail and appropriate remedial measures taken.

3. Woody vegetation on the masonry section of Dam No. 1 is undesirable and should be removed from the face of the dam to facilitate inspection of the seepage and condition of the wall.

4. Since seepage was noted through the masonry section of Dam No. 1, and since the filter control features of the embankment are unknown, the remote possibility of soil piping cannot be discounted. Therefore, in conjunction with seepage monitoring, it is recommended that settlement monuments be incorporated along the crest of Dam No. 1 to monitor if any movement is occurring.

b. Operation and Maintenance Procedures. A maintenance inspection checklist should be developed to help insure

that all critical items are regularly inspected and maintained. This should include the interior of the intake riser and the conduits.

The Pennsylvania Fish Commission has an emergency plan which includes guidelines for observing various conditions of the dam during periods of heavy precipitation. This plan should be expanded to include a procedure in the event of an emergency for warning downstream residents.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Lower Woods Pond Dam*

ID # *PA 00152*

ITEM	REMARKS
AS-BUILT DRAWINGS	*DER files contain several design drawings prepared by Mr. T.F. O'Hara who currently works for the Pennsylvania Fish Commission.*
REGIONAL VICINITY MAP	*See Plate 1, Appendix E.*
CONSTRUCTION HISTORY	*None available in DER files. No data available in Pennsylvania Fish Commission files*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN	*See Appendix E.*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*No data available in DER files.*
RAINFALL/RESERVOIR RECORDS	*No data available.*

ITEM	REMARKS
DESIGN REPORTS	*None available.*
GEOLOGY REPORTS	*None available. See Appendix F.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*None available.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*None available.*
POST-CONSTRUCTION SURVEYS OF DAM	*None available.*
BORROW SOURCES	*Unknown.*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*None known since 1956.*
HIGH POOL RECORDS	*None available.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*Unknown*
MAINTENANCE OPERATION RECORDS	*None available.*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*See Appendix E.*
MISCELLANEOUS	1. *Construction "Permit" issued 9 May 1956.* 2. *"Application" submitted 18 April 1956.* 3. *"Specifications for Rebuilding of Lower Wood Pond" Project P-1874-1. Prepared by Thomas O'Hara.* 4. *Eight black and white photographs dated 1917, 1932, 1930, 1949, 1937.* 5. *"Report Upon the Application" dated April 30, 1956 by DER.* 6. *"Report Upon the Application" dated April 23, 1956 by DER.* 7. *Inspection reports by DER through 1965.* 8. *"Report Upon Lower Woods Pond Dam" dated 3 August 1917.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Lower Woods Pond Dam* County *Wayne* State *Pennsylvania* National ID # *PA 00152*

Type of Dam *Earth & Masonry* Hazard Category *I (High)*

Date(s) Inspection *24 Oct. 78* Weather *Clear & Cool* Temperature *40's*

Pool Elevation at Time of Inspection *94 ± (1)* *1412± (From Quad Sheet)* Tailwater at Time of Inspection *90 ± (1)* *1408± (From Quad Sheet)*

Inspection Personnel:

Mary Beck (Hydrologist) *Vincent McKeever (Hydrologist)* *John H. Frederick*

John Boschuk, Jr. (Geotechnical/Civil) *Ray Lambert (Geologist)*

John Boschuk, Jr. Recorder

Remarks:

Mr. George Casper, Bridge and Watershed Manager, met with the inspection team and provided assistance but was not at the site during the inspection.

The reservoir consists of three dams as shown in Appendix E.

(1) Based on assumed elevation of 100 shown on design drawings.

MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*Yes. See sheet 5a. Some slight seepage was noted at the base of the masonry portion of the main dam. The quantity could not be determined due to dense growth.*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*No unusual distortions were observed. The crest was relatively level.*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*Could not be inspected.*	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*None observed along masonry portion.*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*No unusual movements in alignment were observed.*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

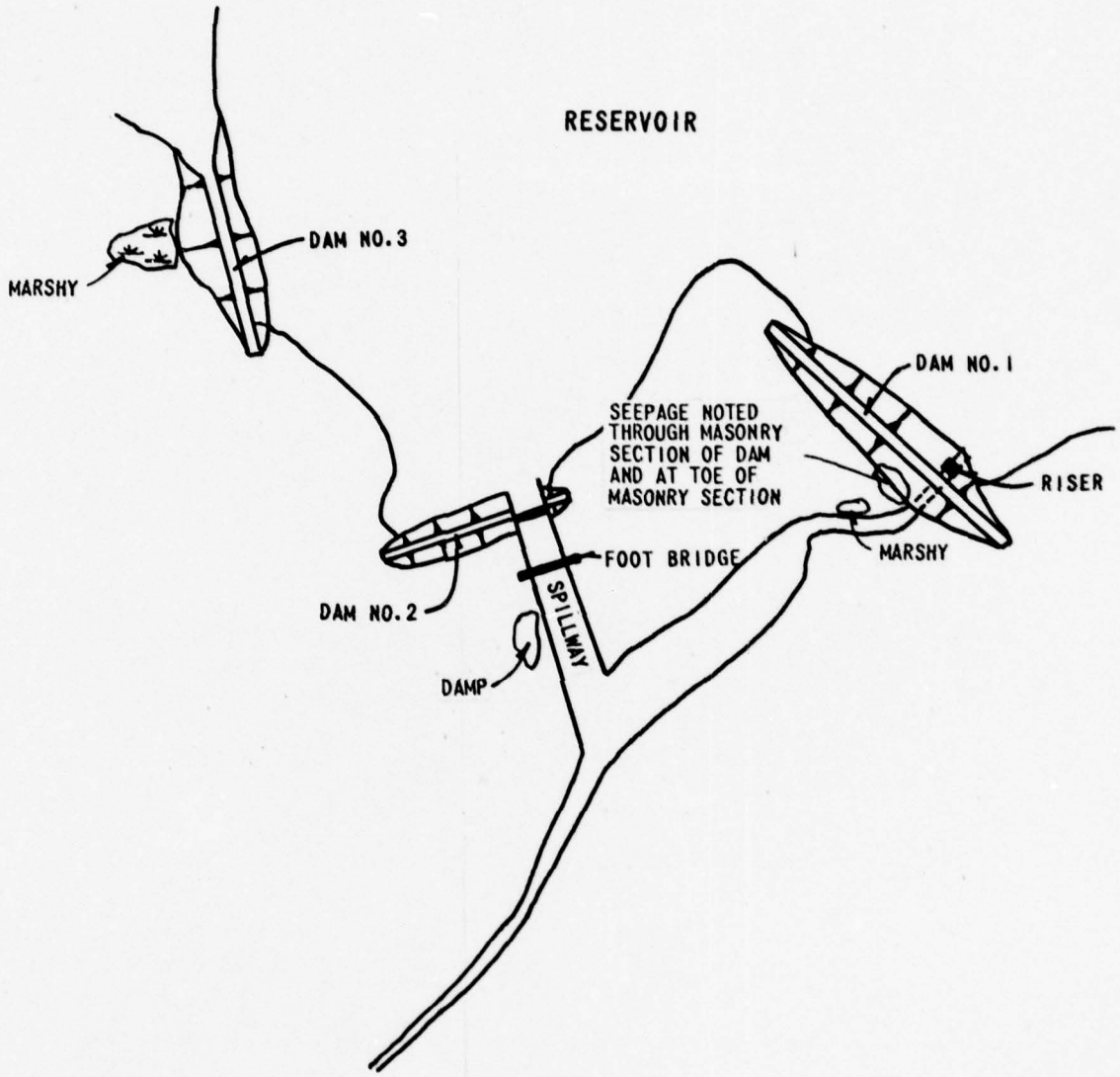
(PERTINENT TO ALL THREE EMBANKMENTS)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*None observed but 0.4 feet of settlement was noted on the right side of the spillway wall. However, the concrete antiseep wall was at the design elevation.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*No movements were observed.*	
RIPRAP FAILURES	*None observed.*	

EMBANKMENT

(PERTINENT TO ALL THREE DAMS)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*No significant erosion or deterioration of the junctions were observed.*	
ANY NOTICEABLE SEEPAGE	*Beyond the toe, marshy areas were noted at all three embankments.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*None observed.*	



SEEPAGE LOCATION PLAN
LOWER WOODS POND DAM

SHEET 5a OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*No cracks were observed at the exit structure of the principal spillway. The end of the box culvert was observed to be in good condition.*	
INTAKE STRUCTURE	*The structure could not be inspected in that the gate was locked.*	
OUTLET STRUCTURE	*The end of the box culvert was observed to be in good condition.*	
OUTLET CHANNEL	*The channel is overgrown but stable.*	
EMERGENCY GATE	*No emergency drain gate.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Sharp crested triangular weir was observed to be in good condition. Two fragments of logs were lodged on the crest but would not appreciably affect the discharge capacity. The logs would flow downstream and lodge against the downstream bridge. See discussion below.	
APPROACH CHANNEL	The approach channel is in good condition.	
DISCHARGE CHANNEL	The discharge channel between the weir and bridge is in good condition as well as beyond the bridge. The bridge and piers are an obstruction but are expected to be washed away during a severe storm.	
BRIDGE AND PIERS	The wood foot bridge with stone piers is in fair condition but is not expected to survive a severe storm.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*None*	
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*None*	
BRIDGE AND PIERS	*None*	
GATES AND OPERATION EQUIPMENT	*None*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Moderate to steep slopes, well covered with timber. Little debris.*	
SEDIMENTATION	*Minimal sedimentation of reservoir, no effect on flood storage.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*Discharge channels from the outlet structure and spillway join about 250 feet below the spillway and flow through a wooded flood plain with moderate underbrush.*	
SLOPES	*Valley gradient is approximately four percent.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*Dyberry Creek crosses Pa. Route 371 near the junction of Dyberry Creek Road about one mile below the dam. At this intersection there are several structures subject to damage. See Plate 1, Appendix E.*	

APPENDIX

C

LOWER WOODS POND

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *More than 85% wooded, some swamp area, no residential development, upstream lake.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *1412 feet (890± Acre-Feet).*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *1418 feet (1470± Acre Feet).*

ELEVATION MAXIMUM DESIGN POOL: ----

ELEVATION TOP DAM: *1418 feet*

EMERGENCY SPILLWAY

a. Elevation *1412 feet.*

b. Type *Triangular weir.*

c. Width *40.5 feet.*

d. Length ----

e. Location Spillover *Through No. 2 dam, see Plate 2, Appendix E.*

f. Number and Type of Gates *None.*

OUTLET WORKS:

a. Type *Standard Fish Commission Tower*

b. Location *Dam No. 1*

c. Entrance inverts *N/A stop logs determine elevation.*

d. Exit inverts *1396.9 feet.*

e. Emergency draindown facilities *Through tower, at elevation 1398.0 feet.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None.*

b. Location *N/A*

c. Records *N/A*

MAXIMUM NON-DAMAGING DISCHARGE: *not determined.*

Note: All elevations based on top of dam at elevation 1418 feet as estimated from USGS Map.

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 12/8/78
By: MFB
Sheet: 2 of 15

DAM Lower Woods Pond Nat. ID No. PA 00152 DER No. 64-11

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.	100.0*		1418.0**
2.	Freeboard, ft.			
3.	Spillway(1) Crest Elev, ft.	940*		1412.0**
3a.	Secondary(2) Crest Elev, ft.			
4.	Max. Pool Elev., ft.	100.0*		1418.0**
5.	Max. Outflow(3), cfs	2280	850cfs/sq mile	
6.	Drainage Area, mi²	3.1	3.04	3.14
7.	Max. Inflow(4), cfs			7620
8.	Reservoir Surf. Area, Acre	91		86
9.	Flood Storage(5), Ac-Ft	0		580

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

(3) At maximum pool, with freeboard, ungated spillways only.

(4) For columns B, C, use PMF.

(5) Between lowest ungated spillway and maximum pool.

* Assumed elevations, not equal to USGS datum
** Estimated from USGS Map

Date: 12/8/78
By: MFB
Sheet: 9 of 15

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from sheet 2)	Source
1A. 3A	Construction drawings dated 10/28/55
5A, 6A, 8A	Application Report dated April 30, 1956
5B, 6B	Calculations dated 2/21/55
7C, 9C	Sheets 13 & 12
6C, 8C	USGS Maps Lake Como (1968) Aldenville (1969)

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

Classification (Ref. Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as "High" as there would be loss of life if the dam failed.
2. The size classification is "Intermediate" based on its 1420 Ac-Ft total storage.
3. The spillway design flood, based on size and hazard classification, is the Probable Maximum Flood (PMF).

Hydrology and Hydraulic Analysis

1. Design data. The spillway was designed to discharge not less than 950 cfs/sq. mile of drainage area for a 3.0 sq. mile drainage area, or 2280 cfs

Spillway capacity. The C was assumed to be 3.82 and the maximum head to be 6 ft

$$Q = C L H^{3/2}$$

$$2280 = 3.82 \cdot L \cdot 6^{3/2} \quad \text{(design)} \checkmark$$

$$L = 40.6 \text{ ft} - \text{use } 40.5 \text{ ft.} \checkmark$$

There was no further hydrologic / hydraulic design.

2. Evaluation of present structure was by the use of the computer program. Computer input data as follows:

Inflow hydrographs
rainfall - ref. Hydrometerological Report No. 33
Snyder's hydrograph parameters. t_p & C_p

$$t_p = C_t (L \cdot L_{ca})^{0.3} \checkmark$$

$C_t = 1.23$ Information received from
$C_p = 0.45$ Corps of Engineers, Baltimore

	Upper Woods Pond	Lower Woods Pond	
L	1.89	2.60	from USGS ✓
L_{ca}	0.52	1.04	maps ✓
t_p	1.22	1.66	✓

BY MFB DATE 12/13/78 SUBJECT Lower Woods Pond Hydrology / Hydraulics SHEET 6 OF 15

CHKD. BY [illegible] DATE 12/18/78 JOB No.

Reservoir routing

elevation - storage, taken from USGS maps, ✓ is shown on sheets 9 & 12.

elevation - discharge data

Upper Woods Pond - determined by Manning's equation through downstream channel, shown on sheet 9

$$Q = a \cdot \frac{1.49}{n} \left(\frac{a}{w.p.}\right)^{2/3} s^{1/2}$$

n (0.08) and channel dimensions obtained from field inspection.

s = 0.010 from USGS map ✓

Note: Upper Woods Pond is a natural lake and as such cannot fail. Dam data shown on sh. 9 are fictitious numbers entered to satisfy the computer programs requirements.

Lower Woods Pond - $Q = CLH^{3/2}$, shown on sheet 12

C = 3.82 design value judged reasonable

L = 40.5 ft. field checked ✓

Overtopping potential - as shown on sheet 15. the spillway discharges 0.5 PMF but the dam is overtopped by 0.6 PMF

Spillway adequacy - the spillway is rated as "Inadequate" but not "Seriously Inadequate".

1 PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT          IUW   INFLOW TO UPPER WOODS POND
ROUTE HYDROGRAPH TO           OUW   OUTFLOW FROM UPPER WOODS POND
ROUTE HYDROGRAPH TO           CUW   CHANNEL ROUTING TO LOWER WOODS POND
RUNOFF HYDROGRAPH AT          ILW   INFLOW TO LOWER WOODS POND
COMBINE  2 HYDROGRAPHS AT     TLW   TOTAL INFLOW TO LOWER WOODS POND
ROUTE HYDROGRAPH TO           OLW   OUTFLOW FROM LOWER WOODS POND
END OF NETWORK
```

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 21 AUG 78
****

RUN DATE= 78/12/08.
TIME= 06.32.54.

LOWER WOODS POND
NAT ID NO. PA 00152 DER NO. 64-11
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .50 .60 .70 .80 1.00

MFB 12/8/78 Lower Woods Pond Hydrology / Hydraulics SH. 7 OF 15

```
**********          **********          **********          **********          **********

                              SUB-AREA RUNOFF COMPUTATION

          INFLOW HYDROGRAPH TO UPPER WOODS POND
               ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
               IUW         0       0       0       0       0       1       0       0

                              HYDROGRAPH DATA
       IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
           1       1    1.26    0.00    3.14    0.00   0.000       0       1       0

                              PRECIP DATA
            SPFE     PMS      R6     R12     R24     R48     R72     R96
            0.00   21.00  111.00  123.00  133.00    0.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS  .800

                              LOSS DATA
     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .05    0.00     .10

                          UNIT HYDROGRAPH DATA
                      TP=  1.22    CP= .45    NTA=  0

                             RECESSION DATA
                STRTQ=   -1.50   QRCSN=    -.05    RTIOR= 2.00

     UNIT HYDROGRAPH 44 END-OF-PERIOD ORDINATES, LAG=   1.23 HOURS, CP=  .45  VOL= 1.00
       24.        88.       175.       253.       297.       292.       258.       227.       199.       175.
      154.       135.       119.       104.        91.        80.        71.        62.        54.        48.
       42.        37.        32.        28.        25.        22.        19.        17.        15.        13.
       11.        10.         9.         8.         7.         6.         5.         5.         4.         4.
        3.         3.         2.         2.

   0                               END-OF-PERIOD FLOW
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q    MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                   SUM  22.34  20.67   1.67   68178.
                                                                      ( 568.)( 525.)(  42.)( 1930.59)
```

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Lower Woods Pond
Hydrology / Hydraulics

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HYDROGRAPH ROUTING

ROUTING THRU UPPER WOODS POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUW	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	1497.0	1498.0	1499.0	1500.0	1501.0	1502.0	1503.0	1505.0
FLOW	0.	52.	171.	356.	603.	921.	1262.	2326.
CAPACITY=	0.	237.	743.					
ELEVATION=	1497.	1500.	1505.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1497.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1600.0	2.5	1.5	200.

PEAK OUTFLOW IS 731. AT TIME 19.75 HOURS

PEAK OUTFLOW IS 921. AT TIME 19.50 HOURS

PEAK OUTFLOW IS 1118. AT TIME 19.50 HOURS

PEAK OUTFLOW IS 1425. AT TIME 19.25 HOURS

PEAK OUTFLOW IS 1858. AT TIME 19.25 HOURS

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Lower Woods Pond
Hydrology / Hydraulics

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HYDROGRAPH ROUTING

CHANNEL ROUTING OF UPPER WOODS POND OUTFLOW

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	CUW	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0600	.0800	1440.0	1460.0	4000.	.02125

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 1464.00 20.00 1454.00 40.00 1444.00 42.00 1440.00 58.00 1440.00
60.00 1444.00 75.0 1449.00 115.00 1454.00

STORAGE	0.	2.	3.	5.	7.	9.	12.	15.	19.	24.
	29.	35.	43.	51.	60.	70.	79.	89.	99.	109.
OUTFLOW	0.	61.	188.	361.	581.	880.	1247.	1692.	2222.	2831.
	3545.	4400.	5410.	6591.	8053.	9736.	11592.	13618.	15811.	18168.
STAGE	1440.0	1441.1	1442.1	1443.2	1444.2	1445.3	1446.3	1447.4	1448.4	1449.5
	1450.5	1451.6	1452.6	1453.7	1454.7	1455.8	1456.8	1457.9	1458.9	1460.0
FLOW	0.	61.	188.	361.	581.	880.	1247.	1692.	2222.	2831.
	3545.	4400.	5410.	6591.	8053.	9736.	11592.	13618.	15811.	1868.

MAXIMUM STAGE IS 1444.7

MAXIMUM STAGE IS 1445.4

MAXIMUM STAGE IS 1445.9

MAXIMUM STAGE IS 1446.7

MAXIMUM STAGE IS 1447.7

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO LOWER WOODS POND

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
ILW		0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.88	0.00	3.14	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.00	111.00	123.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	.07

UNIT HYDROGRAPH DATA

TP= 1.66 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 60 END-OF-PERIOD ORDINATES, LAG= 1.67 HOURS, CP= .45 VOL= 1.00

17.	63.	127.	200.	267.	313.	332.	318.	290.	264.
240.	218.	199.	181.	164.	150.	136.	124.	113.	102.
93.	85.	77.	70.	64.	58.	53.	48.	44.	40.
36.	33.	30.	27.	25.	23.	21.	19.	17.	16.
14.	13.	12.	11.	10.	9.	8.	7.	7.	6.
5.	5.	5.	4.	4.	3.	3.	3.	3.	2.

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.34	20.62	1.72	100765.
										(568.)	(524.)	(44.)	(2853.35)

HYDROGRAPH ROUTING

RESERVOIR ROUTING THRU LOWER WOODS POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OLW	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	1412.0	1414.0	1416.0	1418.0	1422.0
FLOW	0.	438.	1238.	2275.	4892.
CAPACITY=	0.	580.	777.		
ELEVATION=	1412.	1418.	1420.		

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1412.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1418.0	2.5	1.5	830.

PEAK OUTFLOW IS 1799. AT TIME 20.25 HOURS

PEAK OUTFLOW IS 2243. AT TIME 20.00 HOURS

PEAK OUTFLOW IS 3090. AT TIME 19.50 HOURS

PEAK OUTFLOW IS 3872. AT TIME 19.00 HOURS

PEAK OUTFLOW IS 5226. AT TIME 18.50 HOURS

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .60	RATIO 3 .70	RATIO 4 .80	RATIO 5 1.00
HYDROGRAPH AT	IUW	1.26	1	1558.	1870.	2181.	2493.	3116.
		(3.26)	(	44.12)(	52.94)(	61.76)(	70.58)(	88.23)(
ROUTED TO	OUW	1.26	1	731.	921.	1118.	1425.	1858.
		(3.26)	(	20.69)(	26.09)(	31.67)(	40.35)(	52.62)(
ROUTED TO	CUW	1.26	1	731.	920.	1118.	1422.	1859.
		(3.26)	(	20.69)(	26.06)(	31.65)(	40.27)(	52.64)(
HYDROGRAPH AT	ILW	1.88	1	1965.	2359.	2752.	3145.	3931.
		(4.87)	(	55.66)(	66.79)(	77.92)(	89.05)(	111.31)(
2 COMBINED	TLW	3.14	1	2439.	2977.	3524.	4077.	5341.
		(8.13)	(	69.07)(	84.31)(	99.80)(	115.46)(	151.24)(
ROUTED TO	OLW	3.14	1	1799.	2243.	3090.	3872.	5226.
		(8.13)	(	50.94)(	63.53)(	87.50)(	109.64)(	147.98)(

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REV. 1/12/79

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Hydrology / Hydraulics

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SUMMARY OF DAM SAFETY ANALYSIS

UPPER WOODS POND

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1497.00	1497.00	1600.00
STORAGE	0.	0.	10357.
OUTFLOW	0.	0.	29947.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1501.40	0.00	379.	731.	0.00	19.75	0.00
.60	1502.00	0.00	440.	921.	0.00	19.50	0.00
.70	1502.58	0.00	498.	1118.	0.00	19.50	0.00
.80	1503.08	0.00	548.	1425.	0.00	19.25	0.00
1.00	1504.00	0.00	642.	1858.	0.00	19.25	0.00

PLAN 1 STATION CUW

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	731.	1444.7	19.75
60	920.	1445.4	19.75
.70	1118.	1445.9	19.50
.80	1422.	1446.7	19.25
1.00	1859.	1447.7	19.25

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Lower Woods Pond
Hydrology / Hydraulics

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SUMMARY OF DAM SAFETY ANALYSIS

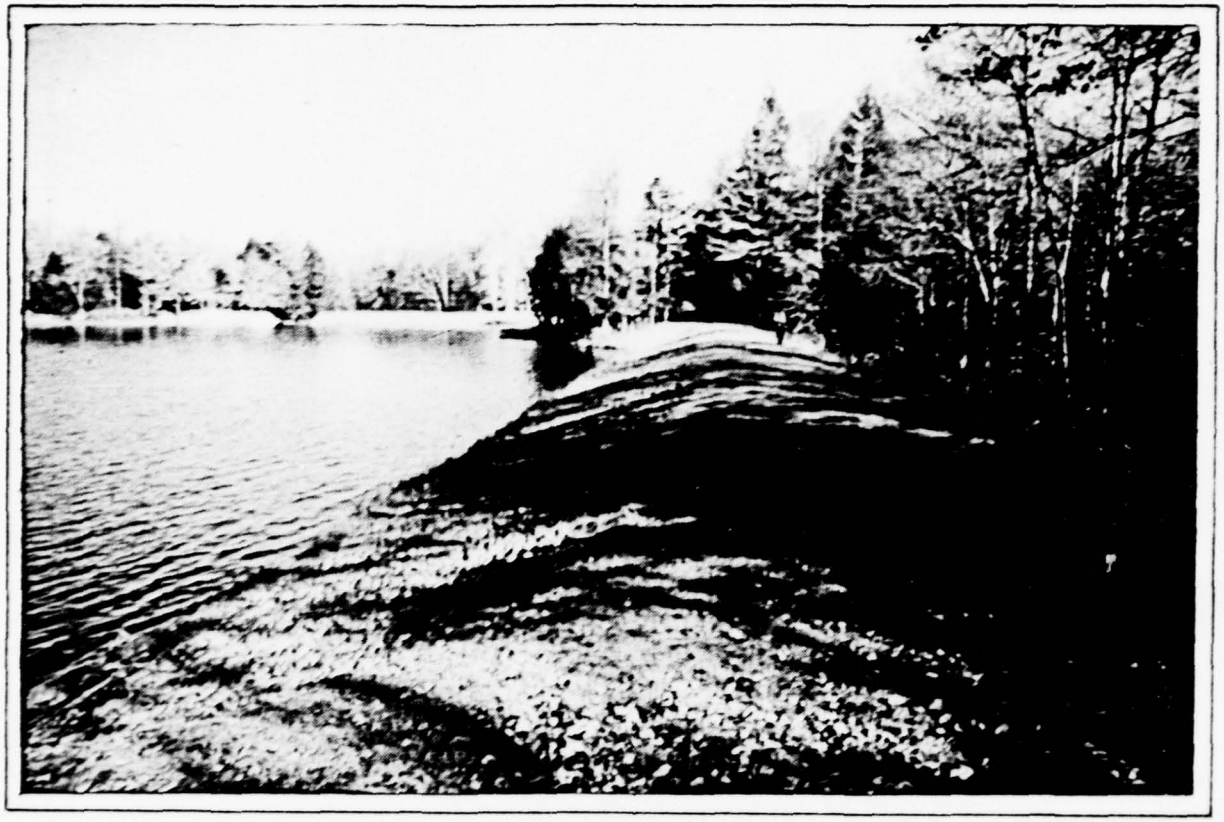
LOWER WOODS POND

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1412.00	1412.00	1418.00
STORAGE	0.	0.	580.
OUTFLOW	0.	0.	2935.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1417.08	0.00	491.	1799.	0.00	20.25	0.00
.60	1417.94	0.00	574.	2243.	0.00	20.00	0.00
.70	1418.35	.35	614.	3090.	2.75	19.50	0.00
.80	1418.63	.63	642.	3872.	3.75	19.00	0.00
1.00	1419.02	1.02	681.	5226.	5.50	18.50	0.00

APPENDIX

D



OVERVIEW OF UPSTREAM SLOPE OF EMBANKMENT NO. 3. EMBANKMENT NO. 2 IS IN BACKGROUND

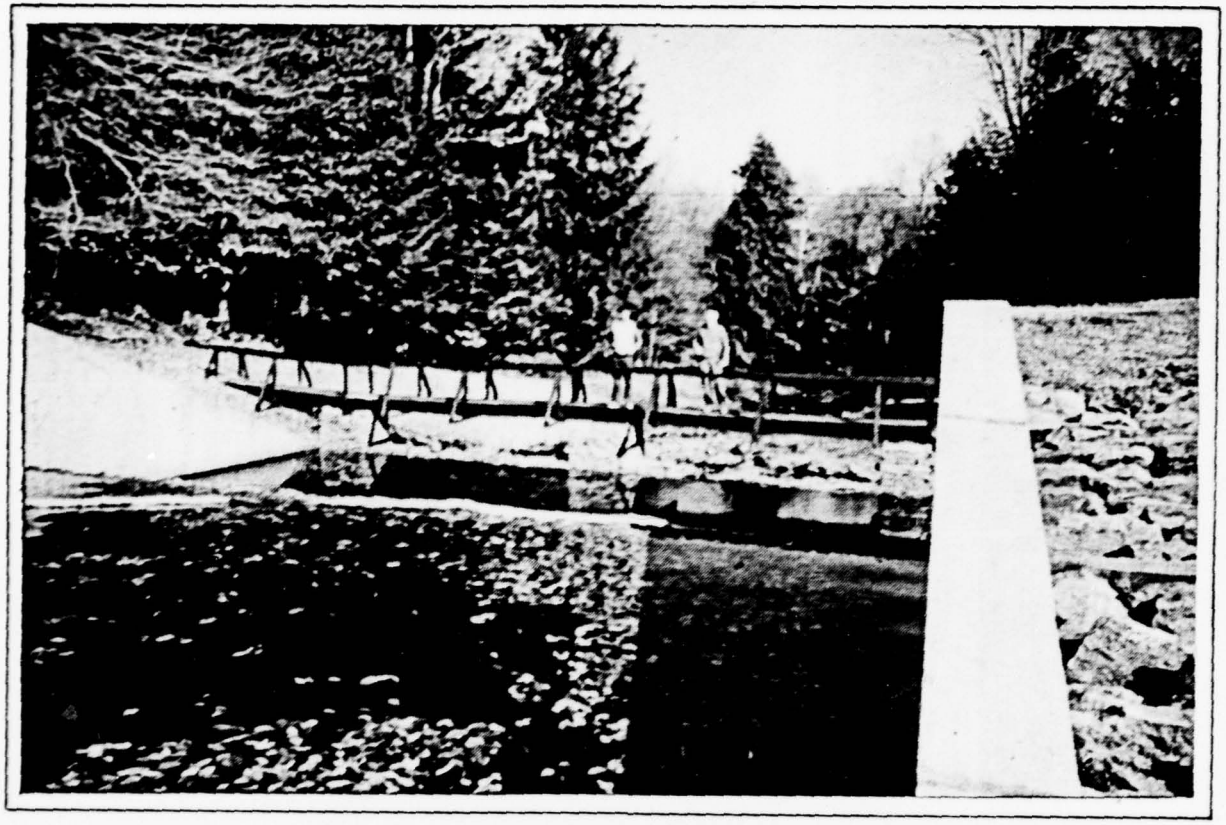
PHOTOGRAPH NO. 1

OVERVIEW OF UPSTREAM SLOPE OF EMBANKMENT
NO. 1 AND INTAKE RISER.

PHOTOGRAPH NO. 2

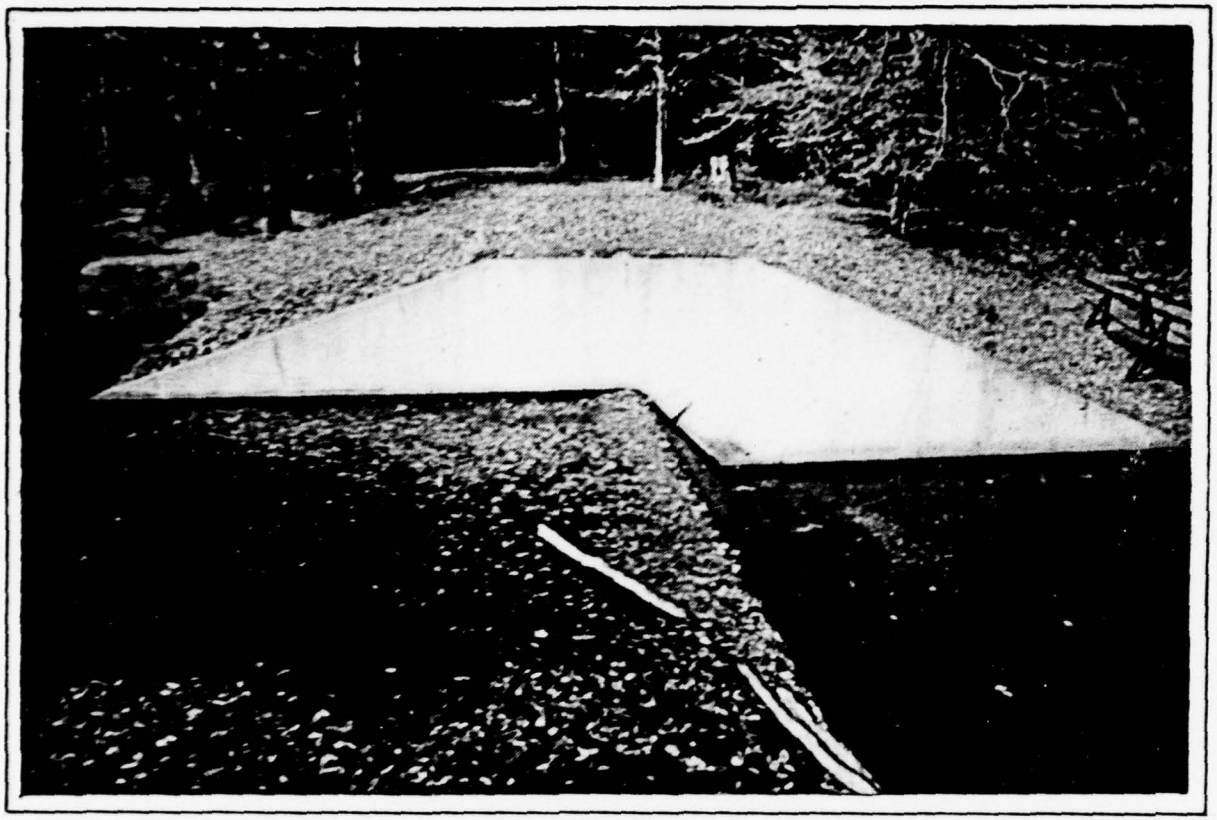
DISCHARGE CULVERT AT DOWNSTREAM TOE
OF EMBANKMENT NO. 1.

PHOTOGRAPH NO. 3



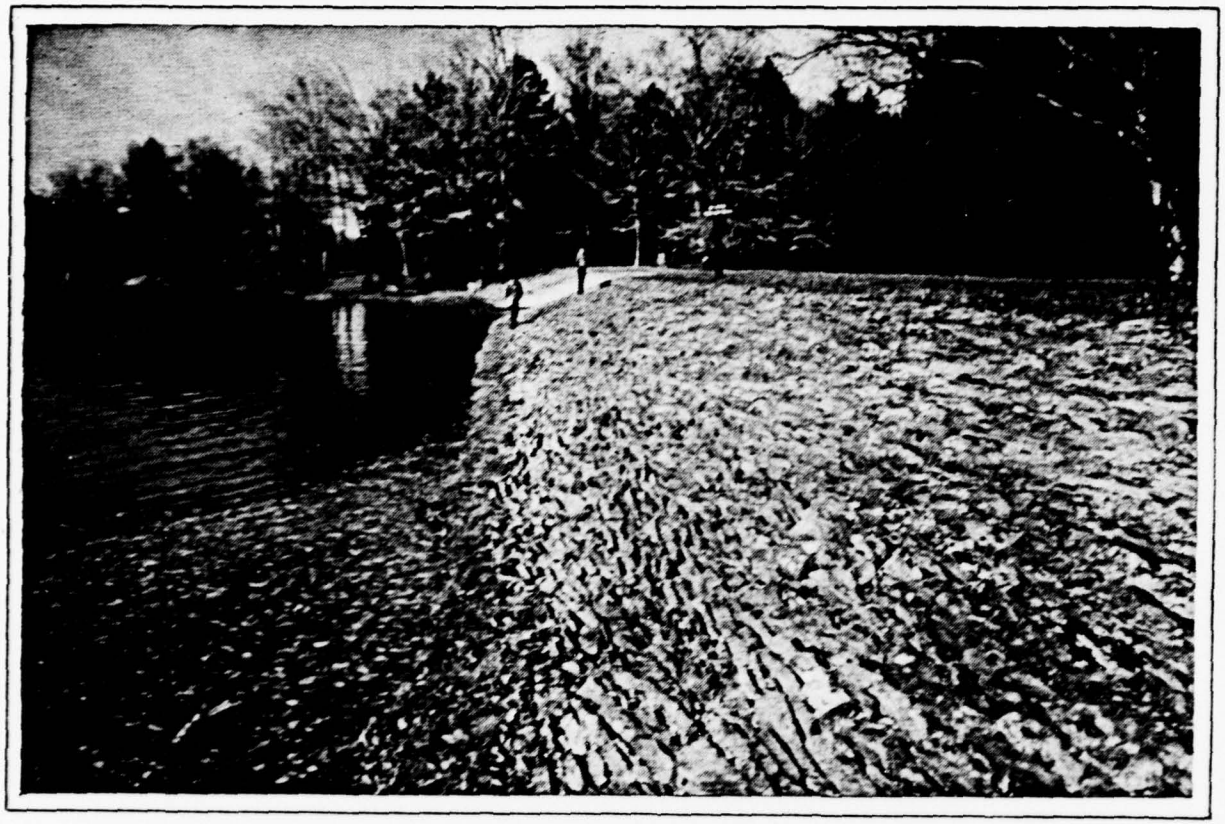
EMERGENCY SPILLWAY. NOTE FOOT BRIDGE
DOWNSTREAM AND EMBANKMENT SETTLEMENT
ADJACENT TO RIGHT SPILLWAY WALL.

PHOTOGRAPH NO. 4



OVERVIEW OF TRIANGULAR WEIR AND
STILLING POOL.

PHOTOGRAPH NO. 5



UPSTREAM SLOPE COVERED WITH HAND
PLACED RIPRAP. EMBANKMENT NO. 2.

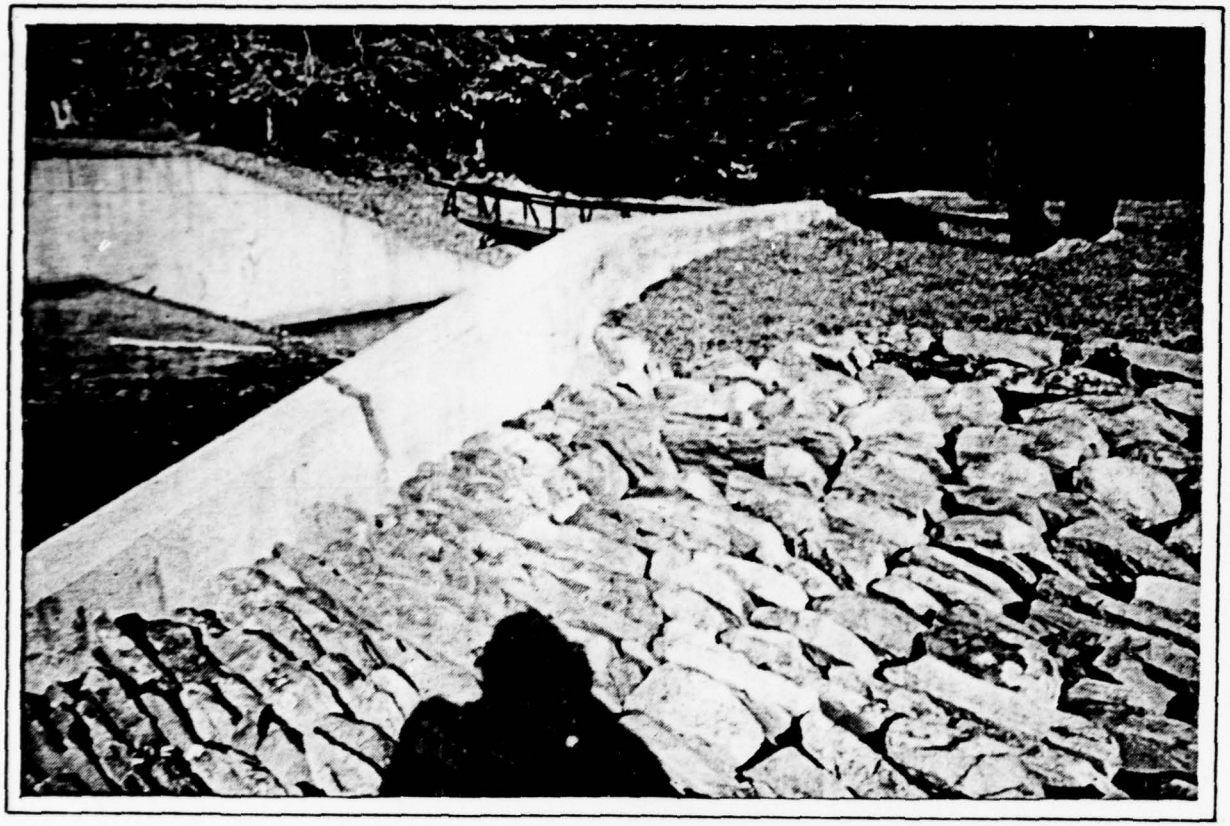
PHOTOGRAPH NO. 6

DOWNSTREAM SLOPE OF EMBANKMENT NO. 1.

PHOTOGRAPH NO. 7

EMBANKMENT NO. 1, DOWNSTREAM SLOPE
COMPOSED OF HAND PLACED ROCK.

PHOTOGRAPH NO. 8

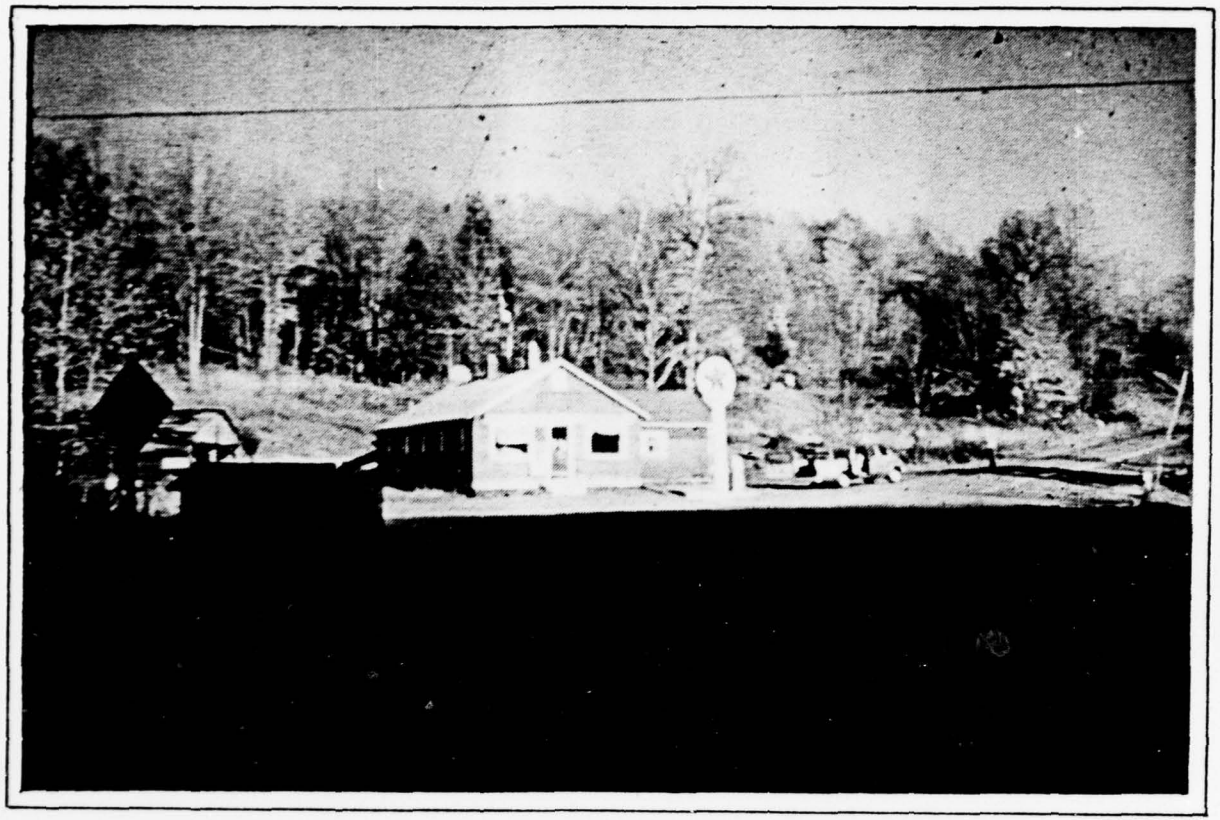


UPSTREAM SLOPE OF EMBANKMENT NO. 2.
NOTE RIPRAP AND EMBANKMENT SETTLEMENT.

PHOTOGRAPH NO. 9

DOWNSTREAM CHANNEL BELOW EMERGENCY SPILLWAY. PHOTO TAKEN FROM FOOT BRIDGE.

PHOTOGRAPH NO. 10



DISCHARGE FLOWS THROUGH POPULATED
INTERSECTION ABOUT 7/8 MILES BELOW
THE DAM.

PHOTOGRAPH NO. 11

APPENDIX

E

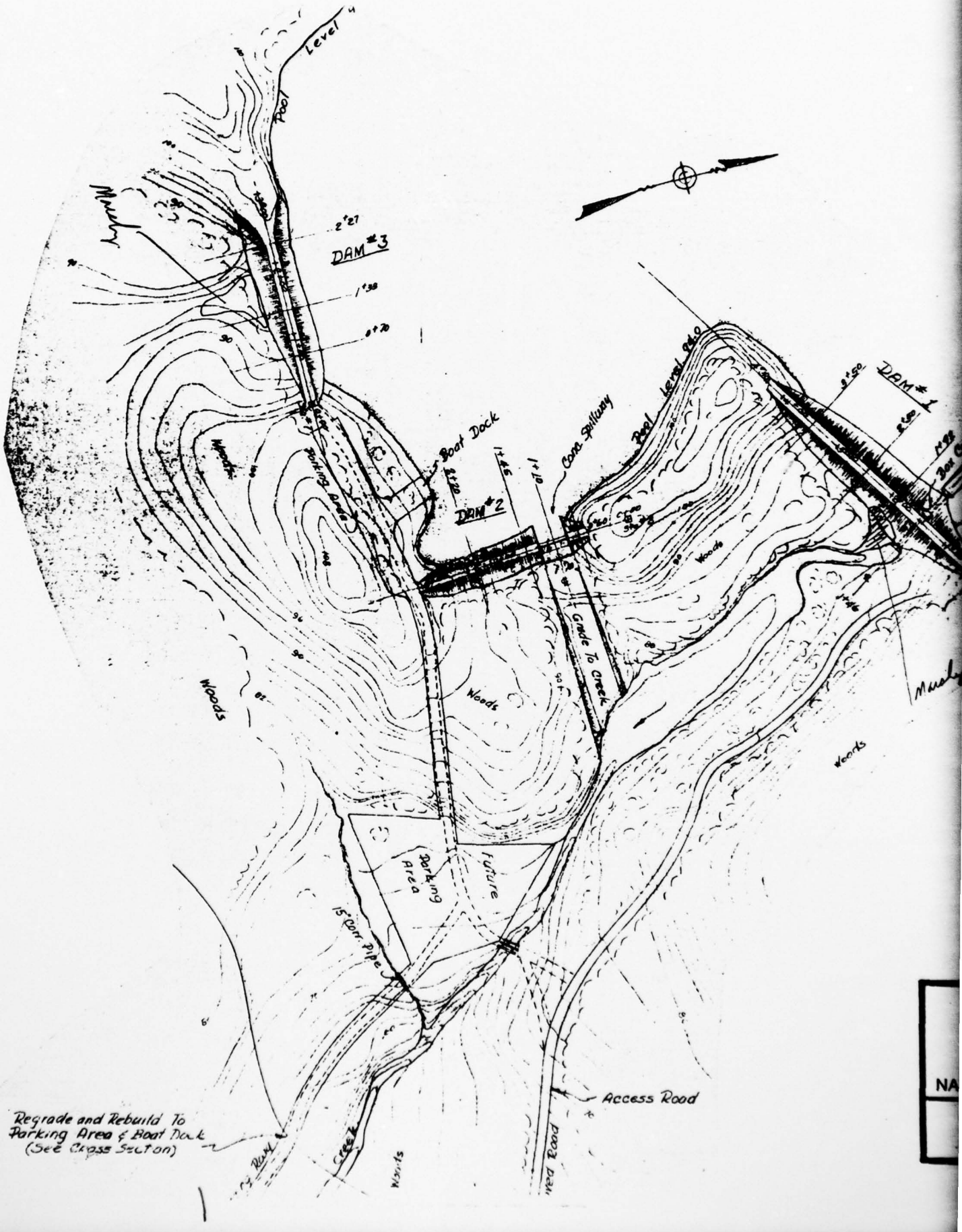
REGIONAL LOCATION PLAN AND HYDROLOGIC MAP

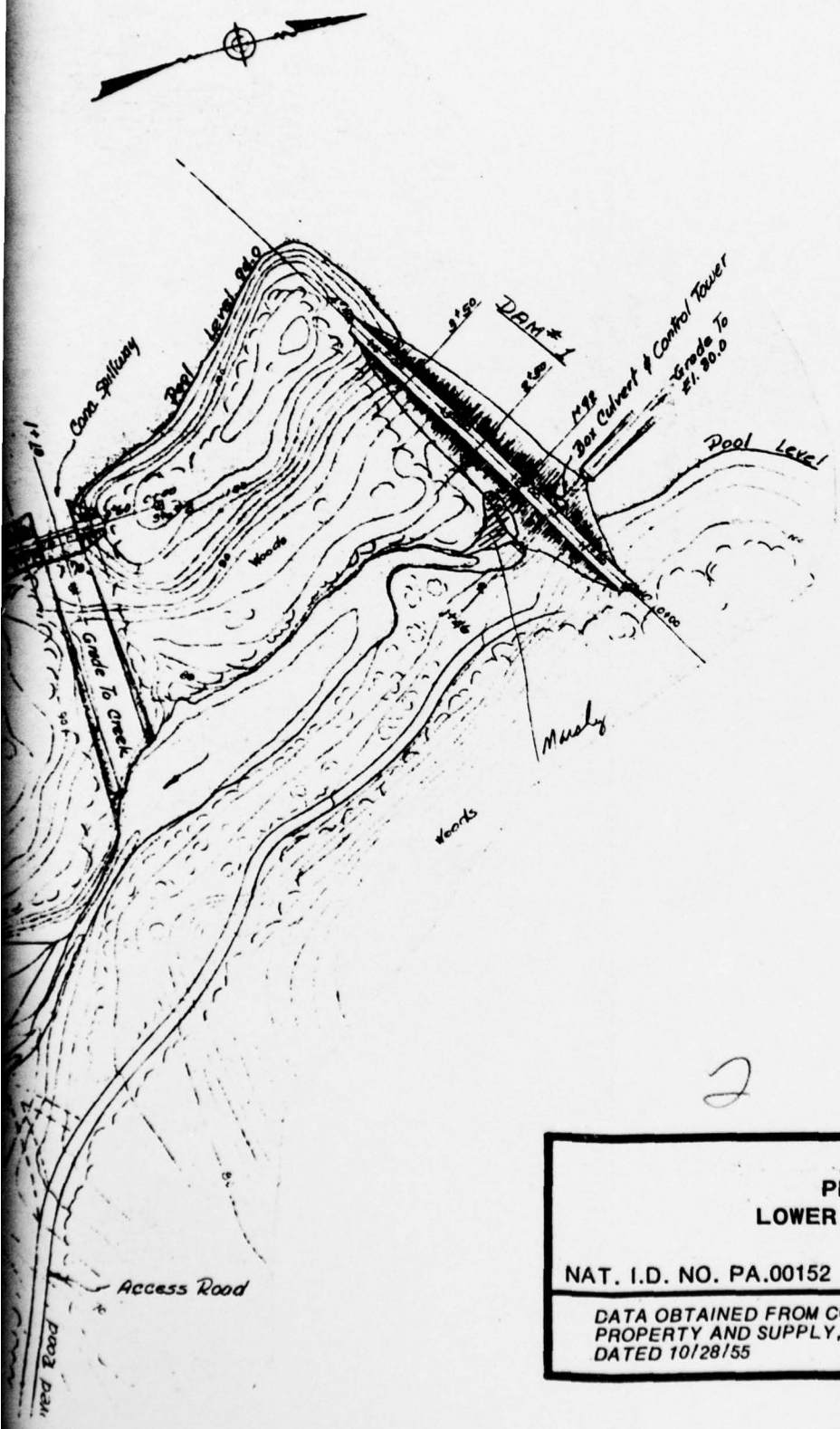
LOWER WOODS POND DAM

NAT. I.D. NO. PA.00152 WAYNE COUNTY

DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEET ENTITLED ALDENVILLE, PENNA.

PLATE 1


Pool Level
Muddy
2'27
DAM #3
1'38
0+70
Woods
Parking Area
Boat Dock
1+45
DAM #2
1+10
Conc Spillway
Pool Level 984.0
DAM #1
Woods
Grade To Creek
Woods
Woods
Future
Parking Area
15" Corr. Pipe
Access Road
Regrade and Rebuild To Parking Area & Boat Dock (See Cross Section)
Creek
Pool Level



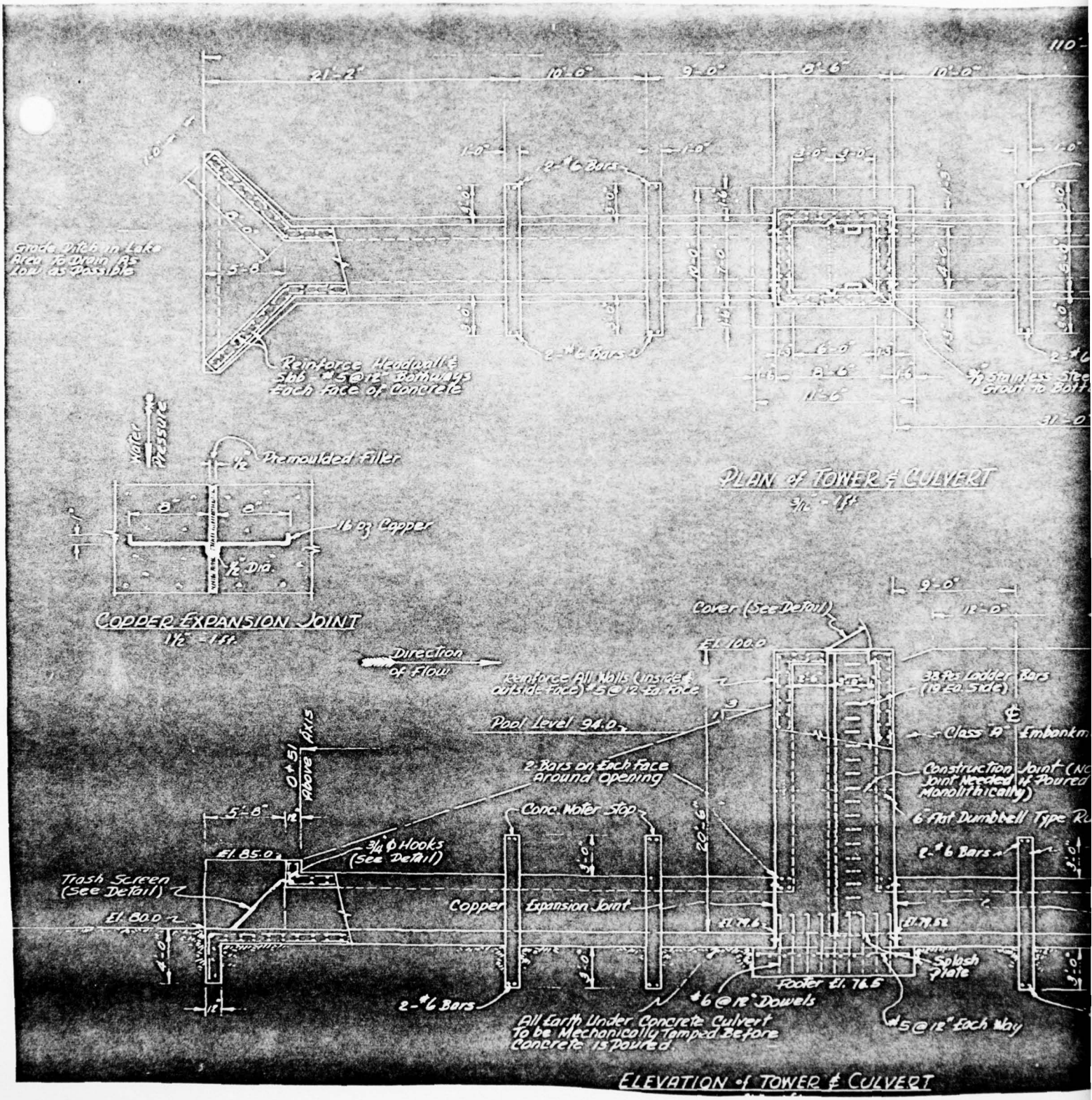
2

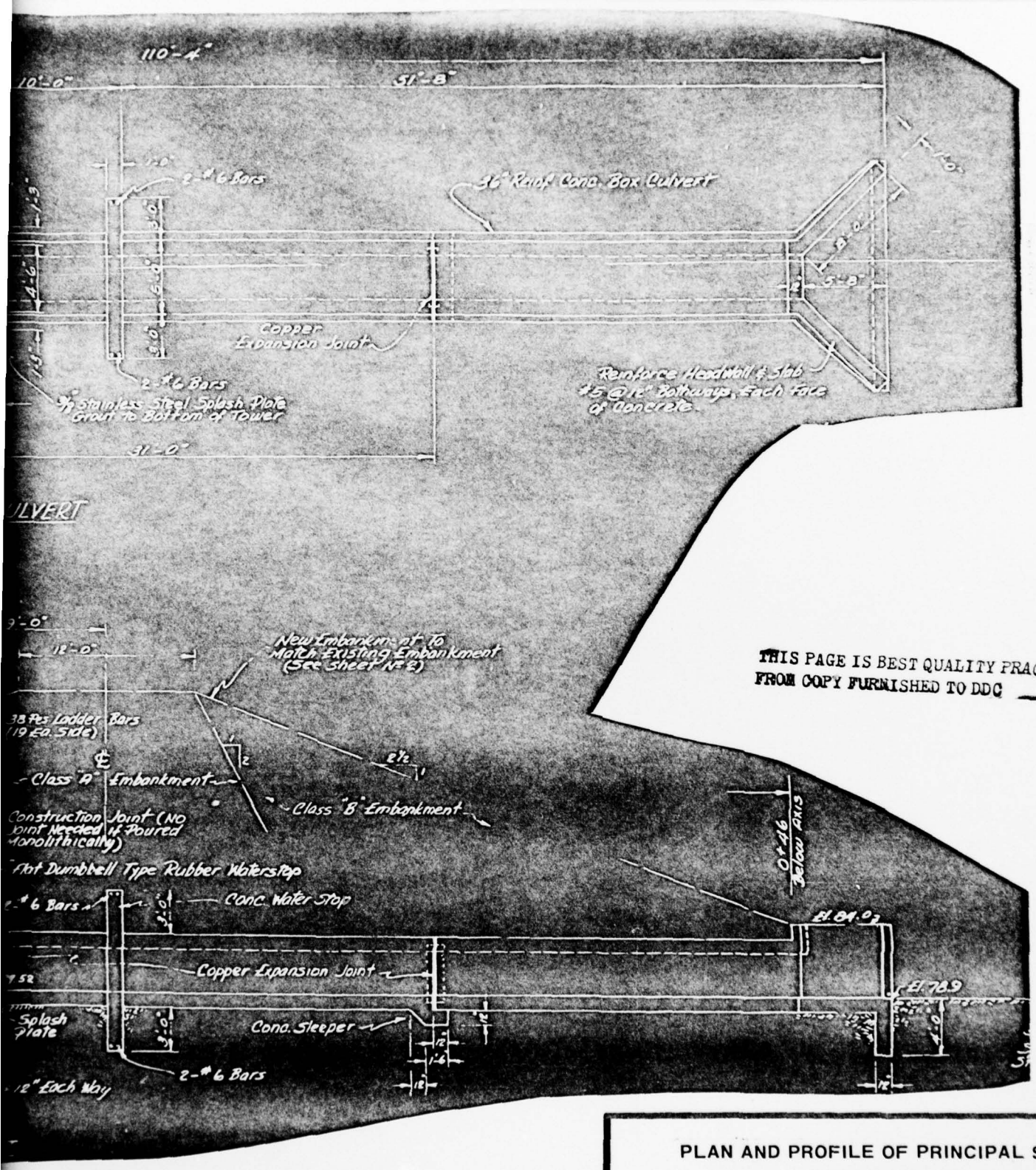
PLAN OF DAMS
LOWER WOODS POND DAM

NAT. I.D. NO. PA.00152 WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. P-1874 -1, SHEET NO. 2 DATED 10/28/55

PLATE 2


21'-2"
10'-0"
9'-0"
8'-6"
10'-0"
110'-
Grade Ditch in Lake Area To Drain As Low As Possible
Reinforce Headwall & Slab #5@12" Both Ways Each Face of Concrete
2-#6 Bars
PLAN of TOWER & CULVERT
3/16" - 1'
Water
Premoulded Filler
16 oz Copper
1/2" Dia.
COPPER EXPANSION JOINT
1/2" - 1'
Direction of Flow
Cover (See Detail)
El. 100.0
Reinforce All Walls (Inside & Outside Face) #5@12 Ea. Face
38 Rs Ladder Bars (19 Ea. Side)
Pool Level 94.0
Class B Embankm
2 Bars on Each Face Around Opening
Construction Joint (No Joint Needed If Poured Monolithically)
Conc. Water Stop
6 Flat Dumbbell Type Re
3/4" ϕ Hooks (See Detail)
El. 85.0
Trash Screen (See Detail)
El. 80.0
Copper Expansion Joint
2-#6 Bars
#6@12" Dowels
Footer El. 76.5
Splash Plate
#5@12" Each Way
All Earth Under Concrete Culvert To be Mechanically Tamped Before Concrete is Poured
ELEVATION of TOWER & CULVERT



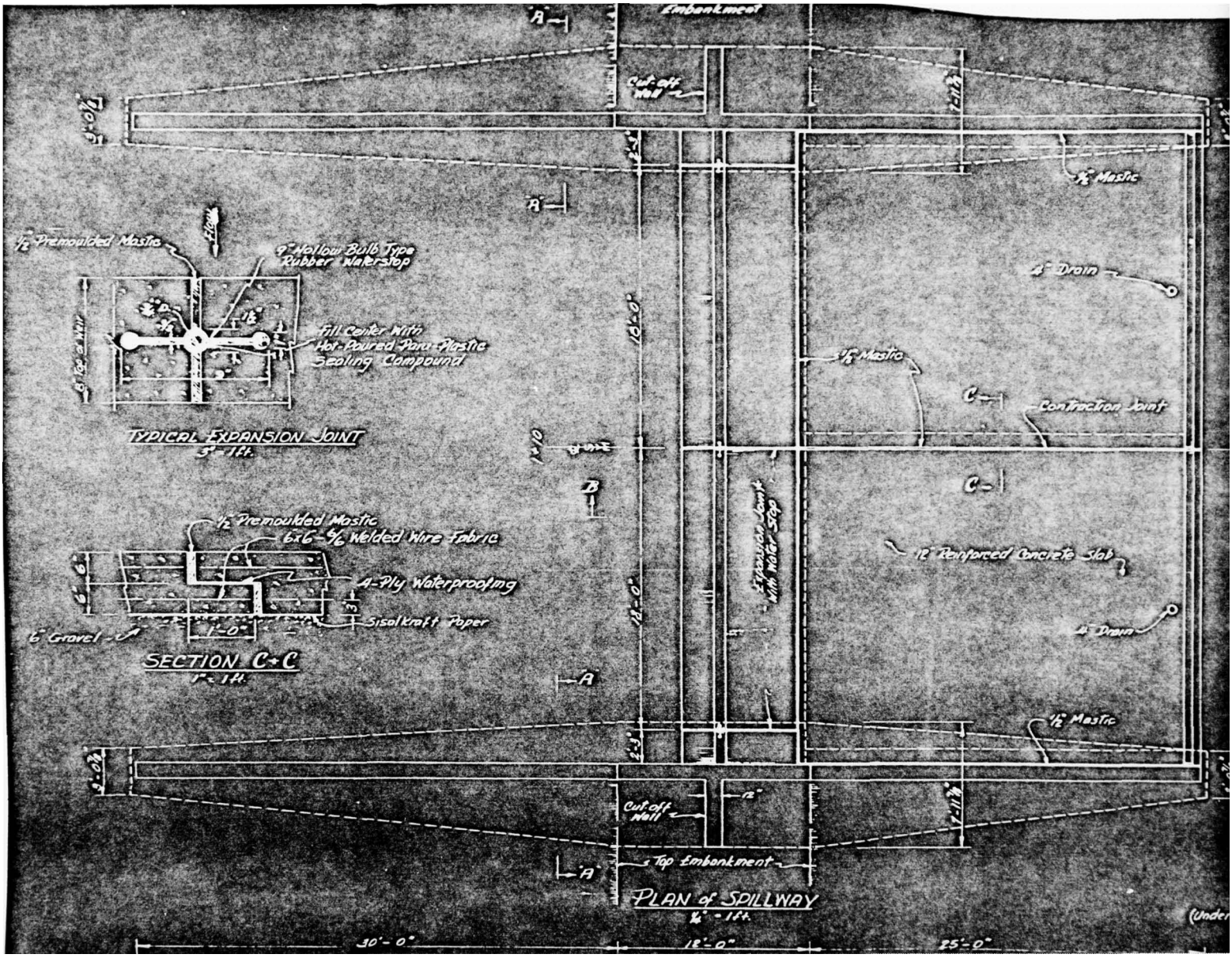
2

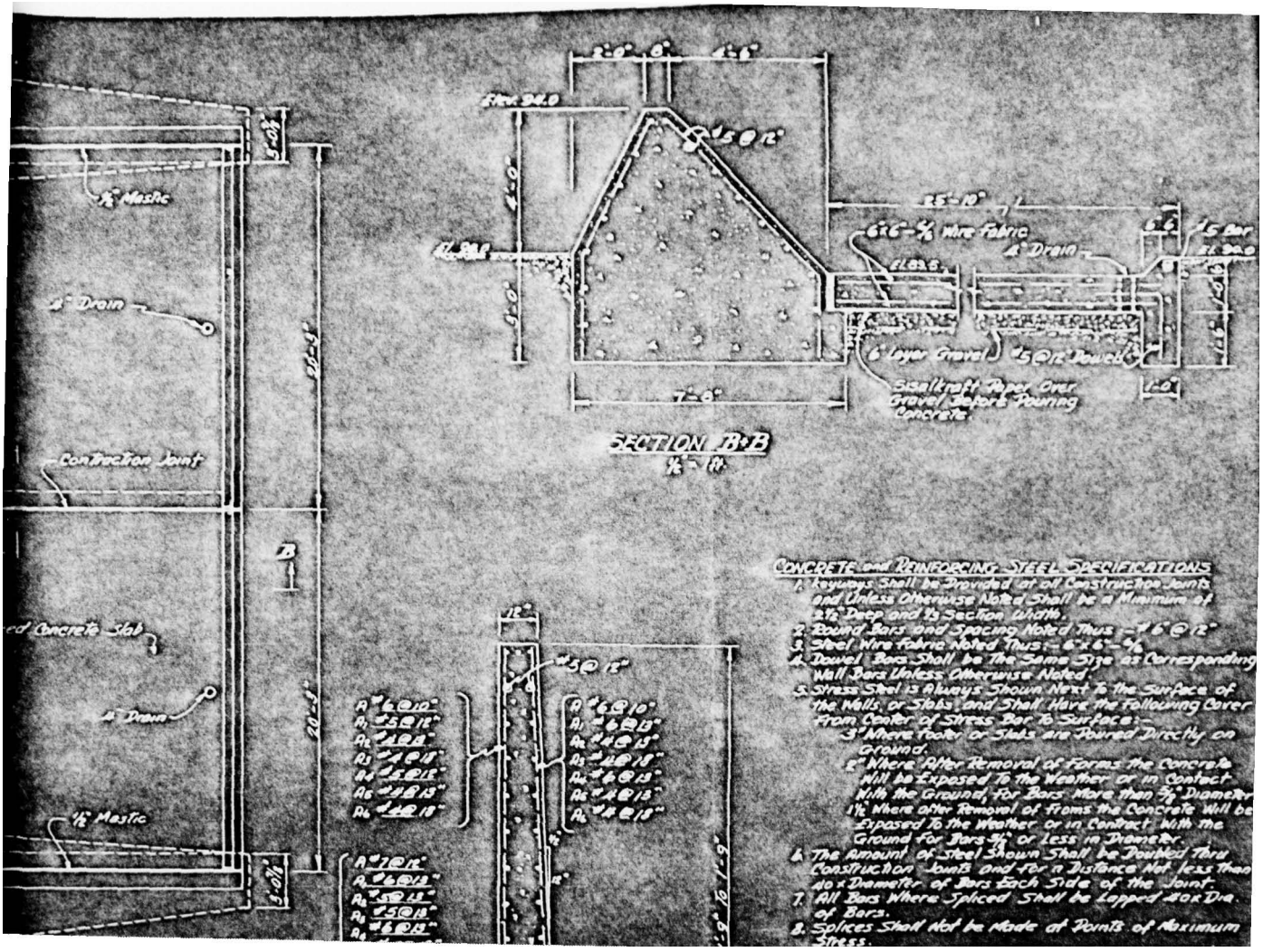
PLAN AND PROFILE OF PRINCIPAL SPILLWAY
LOWER WOODS POND DAM

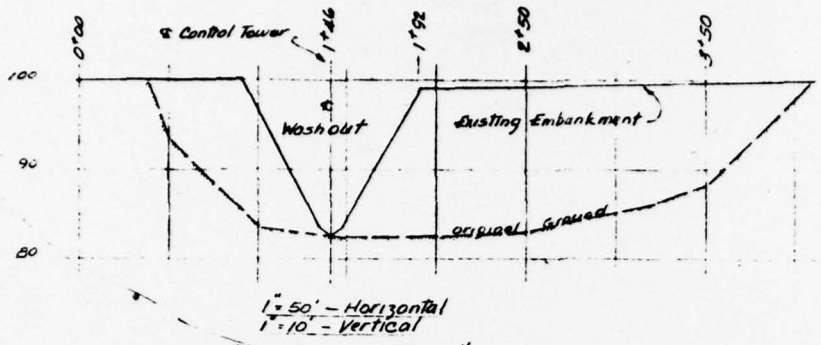
NAT. I.D. NO. PA. 00152 WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. P - 1874 - 1, SHEET NO. 3 DATED 10/28/55

PLATE 3

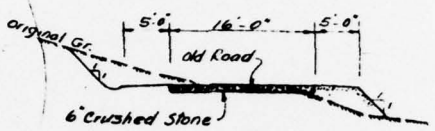

Embankment
Cut-off Wall
½" Premoulded Mastic
Flow
9" Hollow Bulb Type Rubber Waterstop
Fill Center With Hot-Poured Pure Plastic Sealing Compound
TYPICAL EXPANSION JOINT
3" = 1 ft.
½" Premoulded Mastic
6 x 6 - 4/4 Welded Wire Fabric
4-Ply Waterproofing
Sisalkraft Paper
6" Gravel
1'-0"
SECTION C-C
1" = 1 ft.
½" Mastic
4" Drain
Contraction Joint
12" Reinforced Concrete Slab
Expansion Joint With Water Stop
Top Embankment
PLAN of SPILLWAY
1/8" = 1 ft.
30'-0"
18'-0"
25'-0"


Mastic
4" Drain
Construction Joint
Concrete Slab
4" Drain
Mastic
#5 @ 12"
6"x6"-4 Wire Fabric
4" Drain
#5 Bars
6" Layer Gravel
#5 @ 12" Dowels
Sisalkraft Paper Over Gravel Before Pouring Concrete
SECTION B-B
CONCRETE and REINFORCING STEEL SPECIFICATIONS
1. Keyways Shall be Provided at all Construction Joints and Unless Otherwise Noted Shall be a Minimum of 2½" Deep and ⅓ Section Width.
2. Round Bars and Spacing Noted Thus -#5 @ 12"
3. Steel Wire Fabric Noted Thus:- 6"x6"-4
4. Dowel Bars Shall be The Same Size as Corresponding Wall Bars Unless Otherwise Noted.
5. Stress Steel is Always Shown Next to the Surface of the Walls or Slabs and Shall Have the Following Cover From Center of Stress Bar to Surface:-
3" Where Footer or Slabs are Poured Directly on Ground.
2" Where After Removal of Forms the Concrete Will be Exposed To the Weather or in Contact With the Ground, for Bars More than ⅝" Diameter
1½" Where After Removal of Forms the Concrete Will be Exposed to the Weather or in Contact With the Ground for Bars ⅝" or Less in Diameter.
6. The Amount of Steel Shown Shall be Doubled Thru Construction Joints and for a Distance Not Less Than 40 x Diameter of Bars Each Side of the Joint.
7. All Bars Where Spliced Shall be Lapped 40 x Dia. of Bars.
8. Splices Shall Not be Made at Points of Maximum Stress.



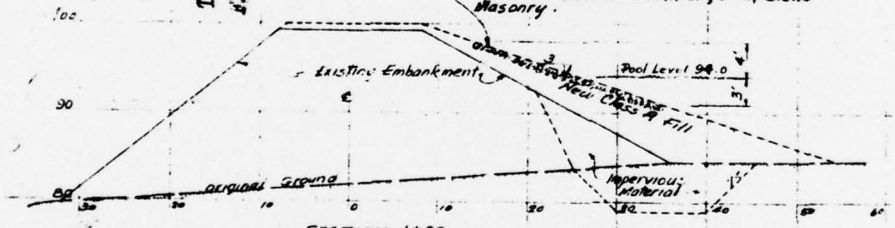
1" = 50' - Horizontal
1" = 10' - Vertical

PROFILE OF DAM # 1



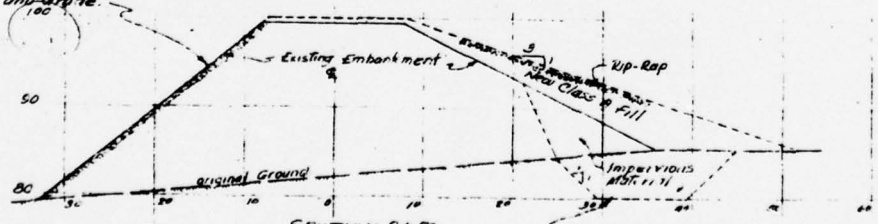
TYPICAL CROSS SECTION of ROAD
1" = 10ft

Rip-Rap: (All 3 Dams)
15" Hand Placed Stone Rip-rap Placed on a Cushion of 6" of Gravel Graded to a Uniform Surface; Fill all Openings With Spalls To Obtain a Smooth Layer of Stone Masonry.



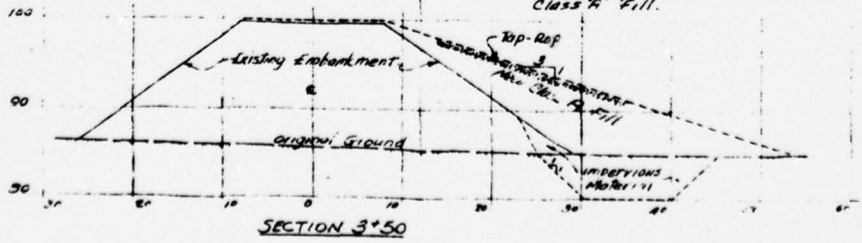
SECTION 1+92

All Existing Stone Rip-rap That is Moved Out of Place, Shall be Kept To its Original Line and Grade.



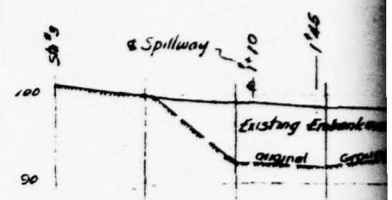
SECTION 2+50

Excavate Cut-off Trench As Shown Entire Length of Dam & Backfill With Class A Fill.

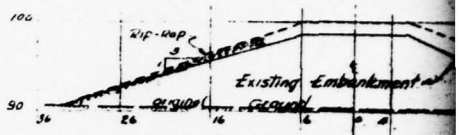


SECTION 3+50

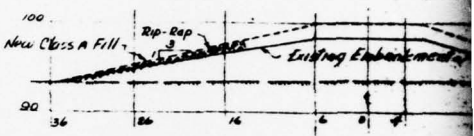
SECTIONS THRU DAM # 1
1" = 10ft.



1" = 50' - Horizontal
1" = 10' - Vertical

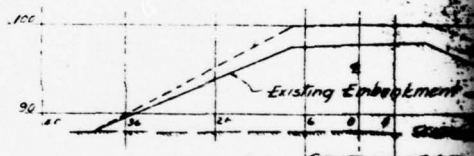


SECTION 1+45

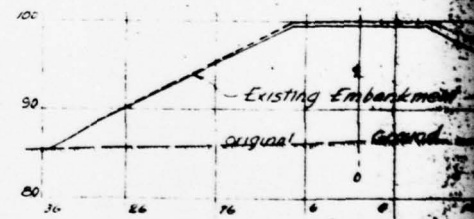


SECTION 2+80

SECTIONS THRU DAM
1" = 10ft.



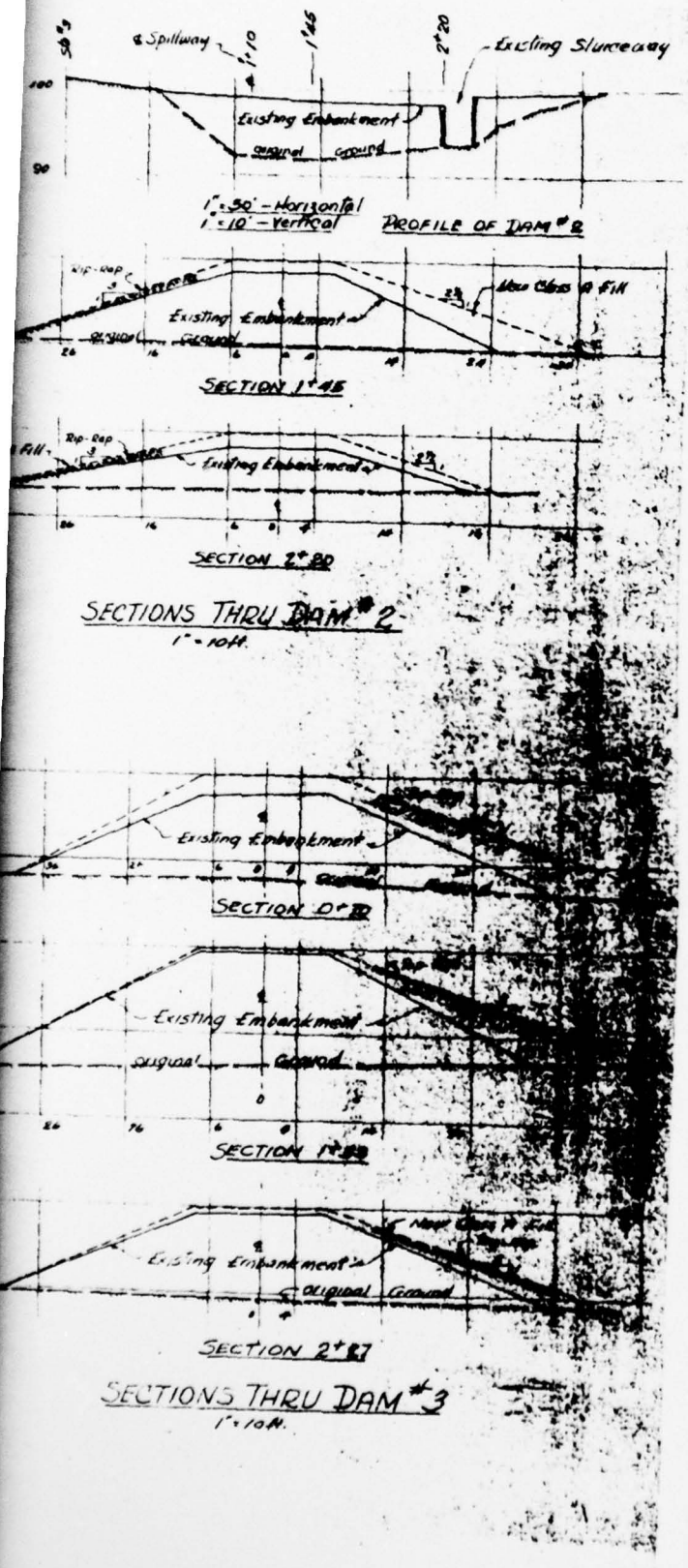
SECTION 0+



SECTION 1+

SECTION 2+

SECTIONS THRU DA
1" = 10ft.



2

TYPICAL EMBANKMENT SECTIONS
LOWER WOODS POND DAM

NAT. I.D. NO. PA.00152 WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. P-1874-1, SHEET NO.2 DATED 10/28/55

PLATE 5

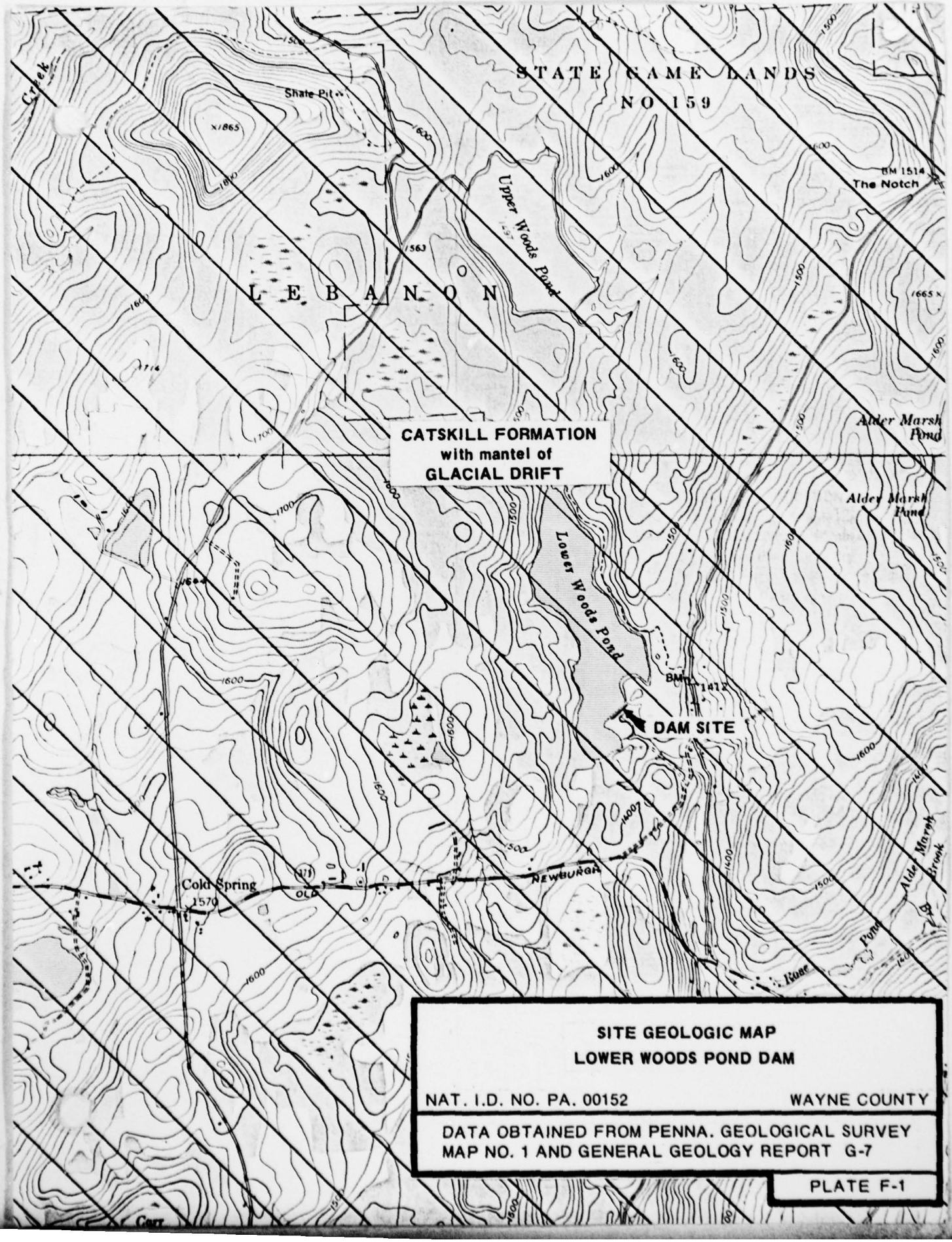
APPENDIX

F

SITE GEOLOGY
LOWER WOODS POND DAM

Lower Woods Pond Dam consists of three embankments which are located in the Glaciated Low Plateaus Section of the Appalachian Plateaus Physiographic Province. As shown in Plate F-1, the dam sites and surrounding region, as is much of northeastern Pennsylvania, are underlain by the Upper Devonian age Catskill Formation which in turn is overlain by Wisconsin age glacial drift. No rock outcrops were observed during the field inspection; however, rock types which characterize the Catskill include interbedded shale, sandstone, siltstone and conglomerate. The glacial drift in the immediate dam site area was noticeably boulder-rich. From available data in State files, it is not clear if any bedrock was encountered during foundation excavation.

It is likely that the embankments are founded upon glacial drift which may account for the seepage observed. Equally, the reservoir area may have been naturally marshy (a characteristic of glaciated terrain) previous to dam construction particularly in the area of Dam No. 3. The most likely areas for seepage would be the original stream channel and at the glacial drift-bedrock interface if either were near existing groundsurface elevations.



SITE GEOLOGIC MAP
LOWER WOODS POND DAM

NAT. I.D. NO. PA. 00152 WAYNE COUNTY

DATA OBTAINED FROM PENNA. GEOLOGICAL SURVEY
MAP NO. 1 AND GENERAL GEOLOGY REPORT G-7

PLATE F-1